The IRON AGE

Contents p. 2 THE NATIONAL METALWORKING WEEKLY August 11, 1949

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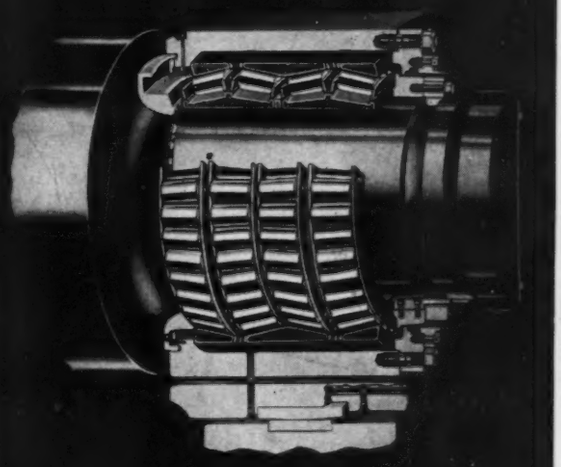
for BIGGER, STRONGER, ROLL NECKS



To help give your rolling mills maximum rigidity and prolong roll life, specify Timken Balanced Proportion bearings for all back-up and work rolls.

Timken Balanced Proportion bearings now make possible bigger, stronger mill roll necks in addition to all of the other well-known advantages of tapered roller bearings namely: elimination of friction; simplicity and ease of lubrication (no pipes, pumps, etc.); radial, thrust and combined load capacity (no special thrust bearings needed); ease of roll changing; restarting of mill after stops without relieving roll pressure and loss of steel.

Timken roll neck bearings are made of Timken special alloy steel with case-hardened contact surfaces and tough inner core for maximum resistance to wear, loads and shock. Applicable to existing and new mills. Consult our roll neck bearing specialists for specific information.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
ROLL NECK BEARINGS

THE TIMKEN ROLLER BEARING COMPANY
CANTON 6, OHIO · CABLE ADDRESS "TIMROSCO"

JUST A ROLL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

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As the white outline indicates, a standard unit of much greater frame size would be required to do the work of Speedaire.

SPEEDAIRES on coke feeders save 53% of space

SAVING space was a prime consideration in this installation of 3 Speedaires—driving coke feeders in an Ohio blast furnace stock house. The Speedaire units, one of which can be seen here, occupy less than half the space required by standard worm gear drives of comparable capacity. In addition, use of Speedaire effected a weight reduction of 825 pounds and saved the steel company $390.00 on installation cost.

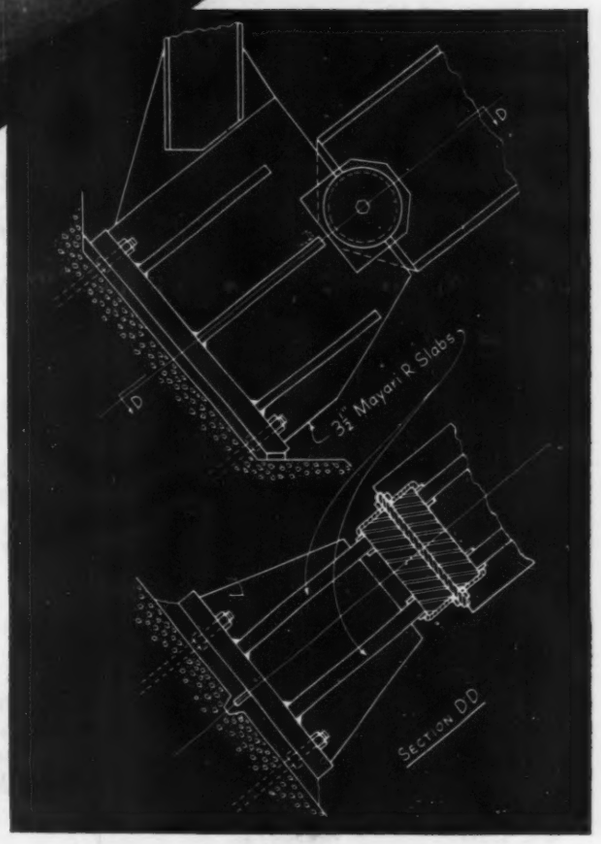
Speedaire is Cleveland's fan-cooled worm-gear speed reducer. Because it is fan-cooled, Speedaire will do more work—will deliver up to *double the horsepower* of standard worm units of equal frame size, at usual motor speeds. It can be installed economically on many applications where other types have been used heretofore—giving you the advantage of a compact right-angle drive. Speedaire gives the same long, trouble-free service characteristic of all Clevelands. For full description, send for Catalog 300. The Cleveland Worm & Gear Co., 3252 East 80th St., Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers, Limited.

CLEVELAND
Worm Gear
Speed Reducers

The Mayari R slabs in the shoes for the highway side of the structure measure 2½ in. thick; those in the shoes for the railway side are 3½ in.

Sketch of shoe, bearing pin and arch rib for Usumacinta River bridge, Mexico. A combination highway and railway structure, the arch measures 492 ft, 1 in. between centers of pins.



High-Strength, Weldable

MAYARI R

Used in Bearing Shoes for Arch Span

Mayari R bearing slabs were used in the shoes of the two-hinged arch bridge over the Usumacinta River in Mexico because the design called for weldable steel with strength equal or greater than that of silicon structural grade. Mayari R met both requirements; it is as easy to weld as carbon steel; it has a yield point of 50,000 psi and a tensile strength of 70,000 psi.

Rapidly gaining favor as a structural material, Mayari R is now being specified in a wide variety of bridges, penstocks, storage silos, coaling stations, smoke stacks, industrial buildings and various types of construction equipment. For further information on the structural applications, properties and advantages of this versatile steel write today for a copy of Mayari R Catalog 259.

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On the Pacific Coast Bethlehem products are sold by
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Mayari R *makes it lighter... stronger... longer lasting*

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Editorial

Between the Extremes 7

News Interpretations

Newsfront 11
The Iron Age Summary 15
On the Assembly Line 38
The Federal View 42
West Coast Progress Report 48
Machine Tool Highspots 52
Global Report 60

Special Features

Fatigue Cracks 20
Iron Age Introduces 22
Free Publications 26
New Production Ideas 27
The Economic Side, J. S. Lawrence 118

Technical Articles

Homogeneous Carburizing 83
PV Test Applied to Gearing Steel 88
AES Studies Methods of Plating and Finishing 91
High Temperature Properties of Magnesia Refractories 98

Spot News of Industry

May Build New Pipe Mill 111
Steel-Union Goodwill Fades 111
Steel Aims at the Public 113
Crystal Balls Gather Dust 114
Machine Tool Report 142

Markets & Prices

Market Briefs and Bulletins 141
Nonferrous Metals Outlook 144
Nonferrous Prices 145
Iron and Steel Scrap Market 146
Iron and Steel Scrap Prices 148
Comparison of Prices 150
Steel Prices 152
Pipe and Tubing Prices 153
Alloy Steel Prices 154
Warehouse Steel and Pig Iron Prices 155

Index to Advertisers 178
Dear Customer 179

Editorial

INDUSTRY VIEWPOINTS

Between the Extremes

POLLYANNA talk won't keep us from going into a business tailspin if we are headed that way. Nor will it bring us out any faster when we are on the way up. But unwarranted pessimism can put us deeper into the trough than we should be. And it can keep us there longer than we need be.

It is true that basic business conditions dictate economic trends when they are not interfered with too much by government policies and action. But it is just as true that the human factor has a lot to do with whether we go too far one way or the other. Excesses in optimism and pessimism have a real effect on our business pattern. More than they should have.

Earlier this year there were three viewpoints on the business outlook. One group believed that we were headed for a good old-fashioned depression. Another felt that we were in a corrective period that would precede several years of normal activity above the prewar level. There were still others who said and believed that everything was rosy and there were no danger spots.

It begins to look as though the people who predicted a corrective period were right. Fortunately their number was great; and fortunately also because most of these people were business leaders who hold the purse strings on large expenditures for expansion and modernization.

There was no doubt that we had to pull in our horns and follow a more normal trend in business. Early in the year metalworking activity confirmed this. At that time it was certain that demand had fallen off, inventories were too large and some prices needed readjustment. Other industrial groups were in the midst of their troubles last Fall. There was no reason to believe that the metal field would escape its share.

But there was no real evidence that we were headed for a repetition of the 30's. Nor was there any reason to believe that we could go merrily on at the dizzy inflationary rate we had "enjoyed" for three years. There is still no sign that we are entirely out of the woods.

We will not in the near future reach 1947 and 1948 peaks in output and sales. But there is evidence that bottom has been reached for the time being. Whether this is a temporary stop before we go down further is beside the point. There is as much chance that we are over the hump as that we are not.

The recent improvement caught the pessimists napping. It made the Pollyannas gleeful. But the in-between fellows are still cautious. Their caution sprinkled with faith in the future of the country is the very thing that has kept the economy from sliding off into a deep and serious depression. May their number increase!

Tom C. Campbell

Editor

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There's Nothing Else Like It: USERS GAIN IN PRODUCTION

FORTY-EIGHT per cent savings — floor-to-floor time! That's the actual result on this job — milling the face of worm-wheel housings. *Mono-Lever controlled* reciprocal milling did the trick. Operator determined cycle and set trip dogs — a matter of seconds. Then using the speedy setup and workholding facilities of the Built-in Chucking Table (a new, exclusive Kearney & Trecker development for simplifying setups and for easy holding of irregular shaped workpieces) he made his setup. Then engaged the *Mono-Lever* — and kept busy loading new workpieces.

NEWSFRONT

NEWS, METHODS AND PRODUCT FORECAST

► Some thought is being given to heat treating 26-in. line pipe. Such pipe—capable of operating at about 1100 psi—could carry as much gas as standard 30-in. pipe at ordinary transmission pressures. Idle gun tube quenching facilities could be used to heat treat 40-ft lengths.

► Plans to build a steel mill in Iowa have been indefinitely postponed. Plentiful steel supply plus shortage of risk capital are the main reasons. Interested parties only purchased the 400 acres of land from the government to fulfill an obligation made over a year ago.

► A shielded arc process has been perfected for welding tantalum. Production of absolutely ductile welds is reported to be possible now since all contamination by minute quantities of gases is eliminated. Very thin sections are being welded satisfactorily. In this practice commercial helium gas is further purified and rectifiers have been added to the welding circuit for closer control of voltage and amperage across the arc.

► Guesses that the steel ingot rate will drop to 65 pct before the end of this year may still be quite safe. Steel operations normally fall off sharply during Christmas week, often set a peak in October.

► A good many zinc users have now run their inventories down to a reasonable level though some have cut them so far they are reappraising buying policies. The low point in zinc orders seems to have been reached a month ago. Galvanized pipe producers, apparently suspecting this, stopped lowering prices when zinc reached 11¢ per lb though it hit a low of 9¢ in June.

► Demand for steel for automobile replacement parts has apparently stabilized following sharp cutbacks this spring. The new level is well below the postwar peak, which in some cases was three or four times the prewar volume.

► One solution to the leakage problem in valves handling corrosive liquids and gases has been found in the elimination of the gasket between bonnet and body. In the new type of valve construction the bonnet is welded to the body casting to make it an integral unit and eliminate the focal point of corrosive attack. The valve will be produced in all high alloys in gate valve sizes up to 2 in.

► Disadvantages of the 3-day coal mine work week are becoming more obvious. Railroad men are afraid that natural gas, fuel oil and hydroelectric power may capture more of coal's declining market—in which case they stand to lose as much as $500 million a year in gross revenues. Furthermore, less efficient mines are gaining at the expense of the more efficient producers, increasing the job of supplying empty cars.

► Some steel research men now believe the country has 10 to 15 million more tons of ingot capacity than we'll need over the next several years. Yet more is still being built. Barring a war it looks as though the industry will have about the normal surplus of capacity over demand for some time—proving that adding capacity is regular business that goes on whether or not bureaucrats beat their gums about it.

► Some English industrialists are concerned because the dollar shortage threatens their ability to buy high production machinery in the U. S., further reducing their competitive export position.

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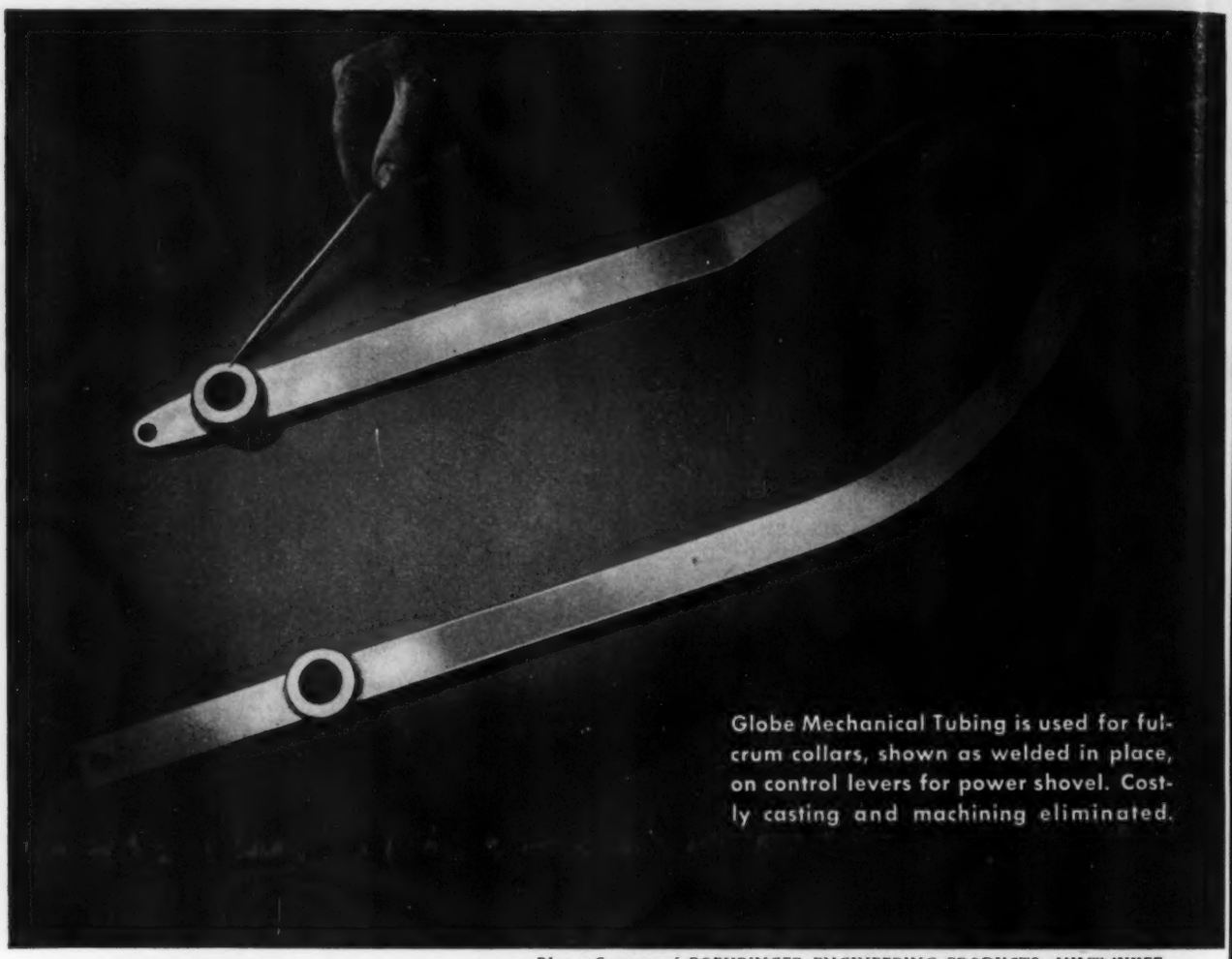

Globe Mechanical Tubing is used for fulcrum collars, shown as welded in place, on control levers for power shovel. Costly casting and machining eliminated.

Photo: Courtesy of BOEHRINGER ENGINEERING PRODUCTS, MILWAUKEE

DESIGN to cut production time and costs

DESIGN with Globe Mechanical Tubing

A Versatile Engineering Material . . . Globe Mechanical Tubing is a semi-finished material for the making of structural parts — bracers — rods — spacers — sleeves — pins — bushings — struts — frames — housings — spindles — rollers — shafts — cylinders — containers — slideways — rings — bearing races — a variety of tubular sections.

Look to Globe Mechanical Tubing when you are looking for ways and means to cut costs — to simplify production — and improve product design and performance as well.

Here is a versatile engineering material offering many advantages: inherent structural strength — minimum weight — dimensional accuracy — the reduction or elimination of many machining operations — less time-demand and wear and tear on machine and cutting tools.

We welcome an opportunity to work with you to explore the possibilities of Globe Mechanical Tubing for your products — write —

Globe Steel Tubes Co., Milwaukee 4, Wis.

Seamless Stainless Steel Tubes
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Globe Welding Fittings

Labor Clouds Better Steel Outlook

Ingot Rate Climbs Another Point

More Steel Scrap Prices Increase

The Iron Age SUMMARY

IRON AND STEEL INDUSTRY TRENDS

IF A VERY real threat of labor trouble weren't ahead, steel people would be more optimistic about the future this week than they have been for months. From the standpoint of money in the bank, business on the books and more buying by some of their customers, the industry's executives have reason to be cheerful.

But the unfinished business just ahead is enough to give anyone the creeps. This week the steel companies open their case before the Presidential fact finding board in an atmosphere completely lacking the good will that used to exist between them and their union. The threat of an automotive strike, the costly 3-day week in the coal mines and the continued sluggishness in some consumer lines cloud the horizon.

Violence in an organizing drive at Chicago and two wildcat strikes there last week show the temper of the steelworkers' union. Union officials came up with some heavy artillery in presenting their side of the wage-pension-insurance dispute before the fact finding board in New York. They coined phrases that made headlines and put steel companies in a position where they must inject real color into their presentations.

Steel Prices Are at Stake

In the normally reticent steel industry there are many this week who are ready to trade phrases with the union. The extent to which these people can get their points across without bogging down in figures will determine what the public thinks about the dispute. If steel loses its case its customers can bid farewell to any hopes of lower steel prices for some time to come. Also on the higher cost side of the ledger are (1) expensive coal stocks bought to counter the Lewis strike threat and (2) higher costs (well over $59 million a year for the industry) due to the 3-day mine work week.

The firmness that appeared last week in steelmaking scrap was further extended to more markets and more grades of scrap this week. THE IRON AGE scrap composite advanced just 8¢ per gross ton this week to $20.00 based on firmness at Pittsburgh. Steel scrap prices have long been regarded as a business barometer. When they began to fall this January few believed they heralded a downturn in steel operations—but steel operations started to slip just a few months later. It will take a while to see if the current change is an uptrend or just a shakeout of prices that fell too low.

In a smaller measure, the steel order pattern during the past few weeks was a repetition of last year. Many plants had then shut down, cut inventories and extended vacations. A lot of sales managers thought business was in for a slump. When they got back to their desks they found orders piled high, inventories depleted and customers yelling for delivery.

Looks Like Summer of 1948

This year looks like a miniature of last. Only this time there is no steel shortage, inventories are under strict control and steel prices are lower than they were in the days of the premium price, the gray market and the conversion deal. Just how long the brighter steel picture will last cannot be told now but it may stick through October and into November, if there are no big strikes.

It is true that steel-strike fears have tightened up steel supply. But it may be that the strike threat opened steel users' eyes to something they had not seen before—that steel was not due for a repetition of the debacles of 1921 and 1937-38. In the latter periods steel consumers' inventories were far higher than they are now and total steel buying wasn't on the present broad plane.

Good Third Quarter Rate Predicted

Incoming steel order volume has slackened a bit following a flurry of new business during the past few weeks, but backlogs have been pushed well above what they were at the beginning of July. In Pittsburgh some new orders are being scheduled for late September. Flat-rolled products are practically booked full for the third quarter there. Unless there is a new rash of cancellations, Chicago mills will hold third quarter operations at a very high level.

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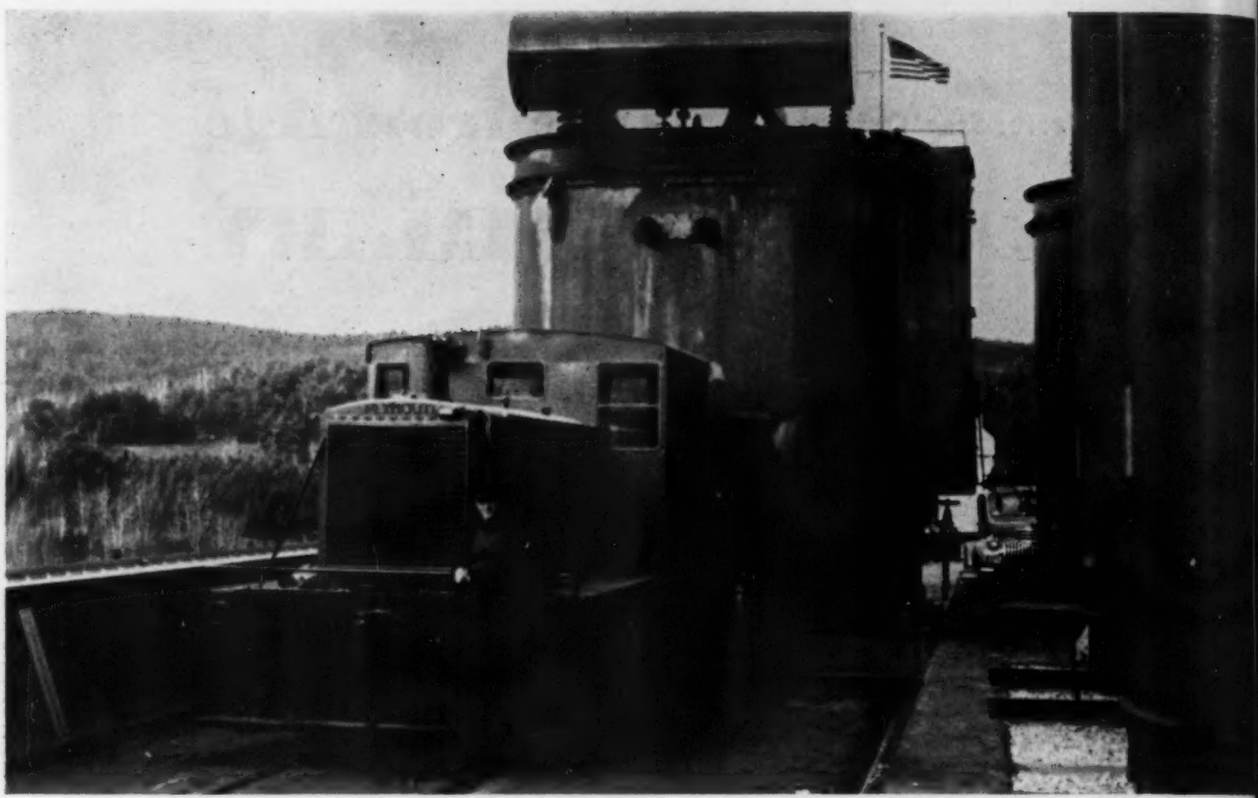

Another Record Proves Maximum Dependability and Minimum Maintenance of PLYMOUTH LOCOMOTIVES

Heavy hauling jobs like this are all in the day's work for this sturdy 30-ton Plymouth gasoline locomotive. Chiefly employed for general haulage of freight from main lines to the Connecticut River Power plant at East Barnet, Vt., the Plymouth Locomotive is always available for other intra-plant transportation of machinery and supplies.

Mr. H. B. Soper, division superintendent of the plant, states that in two years of service this Plymouth has never been laid up for repairs. The total amount of maintenance required, he says, consists only of regular lubrication.

Hauling and switching freight cars over 3 miles of standard gauge track, this Plymouth Locomotive has brought time-saving convenience and ease of handling to reduce hauling costs for the Connecticut River Power Co.

Plymouth Locomotives are available in standard and narrow gauge models . . . in gasoline, diesel - electric or diesel - mechanical. Every model, from the little 3½-ton size to the 70-ton heavyweight, is engineered for efficient, cost-cutting operation on every hauling job. For full information on the size and model best suited for your own hauling needs write today for FREE bulletin. Plymouth Locomotive Works, Dept. A-2, Plymouth, Ohio.

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- Slitting Lines
- Scrubbing and Drying Lines
- Continuous Strip Galvanizing Lines
- Sheet Galvanizing Lines
- Continuous Strip Long Terne Lines
- Continuous Electrolytic Tinning Lines
- Hot Dip Tinning Equipment
- Cutting-off Machines
- Continuous Pipe Galvanizing Equipment
- Mill Tables
- Cooling Beds
- Drawbenches
- Bar Turning Pointers
- Hydraulic Squeeze Pointers
- Wire Pointers
- Bending Machines
- Wire Drawing Machines
- Rolling Mill Rolls

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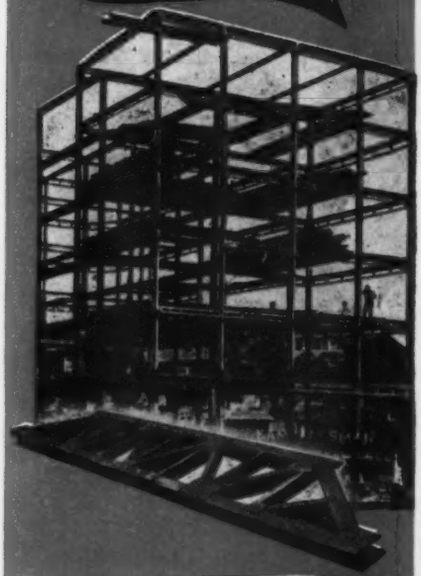
STRUCTURAL STEEL FABRICATION



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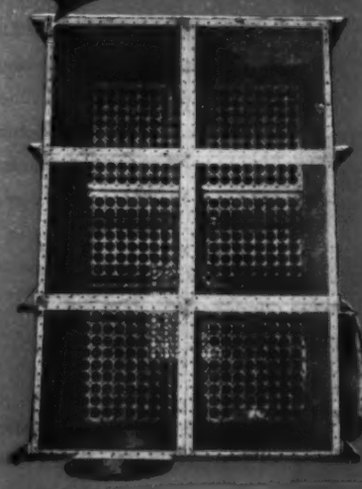

We are prepared to furnish any type of fabrication in any metal to your particular specifications. Write...

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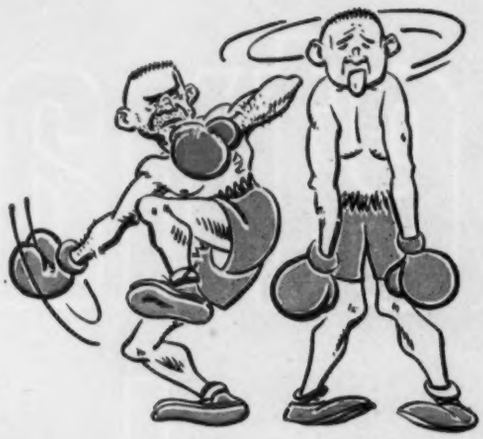


Fatigue Cracks

By Charles T. Post

ESSENTIAL

• • Britain's dollar crisis is almost as severe as our own personal difficulty along the same lines. Before the British finance ministry will approve an expenditure for an American item, it first must be shown that (a) there is no possible substitute produced domestically and (b) the item in question is absolutely essential. As may be imagined, obtaining approval for a subscription to an American magazine is something less than easy.

Just how difficult it is was recently explained to the Washington staff of your f.f.j. over a luncheon table at the National Press Club. Mr. H. A. Whitely, a member of the recent group of visitors from the British drop forging industry, is not only an efficient engineer but apparently a very determined man. As he describes it, the procedure is similar to a department head in Washington justifying his budget proposals before Congress.

"I got our renewal approved," Mr. W. explained jubilantly. "Also, your circulation chaps saw to it that we also received the back issues we had missed in the meantime."

It's nice to know that austerity has its limits and that your f.f.j. is on the essential list. Life can be quite satisfying with a few simple wants. As the poet said:

"Here with a Loaf of Bread beneath the Bough,
A Flask of Wine, an IRON AGE —and Thou
Beside me singing in the Wilderness—
Ah Wilderness is Paradise enow."

MORE THAN

• • Ethan W. Vars, chief engineer, Aldon Products Co., is a pin sticker-inner.

With what this court would count as wholly pardonable pride, one of the best known rolling mill equipment manufacturers preened itself in its July 21 advertisement in your f.f.j. "More continuous butt weld pipe mills than all companies combined" said the big letters that led off a message to whoever might be interested in a butt-weld pipe mill.

"Does it mean they made more mills than themselves? Plus all the others? Gets me all snarled up in an argument with myself. Makes me wonder about too many things and interrupts the learning processes, setting at naught the educational force which is, at heart, the sole reason for THE IRON AGE."

If the pipe mill people had said "More continuous butt weld pipe mills than all *other* companies combined," Mr. Vars would have been happy. But the legal beagles of the Department of Justice's antitrust division might have popped up to inquire (a) Are the other pipe mill people combining to make pipe mills? (b) Does an ominous concentration of power exist in the pipe mill business?

From a strictly practical standpoint, there wasn't room for the word *other* in the advertisement anyhow. You remember the newspaper make-up man with one eye on the motto, "All the news that's fit to print." His private version was, "All the news that fits, we print."

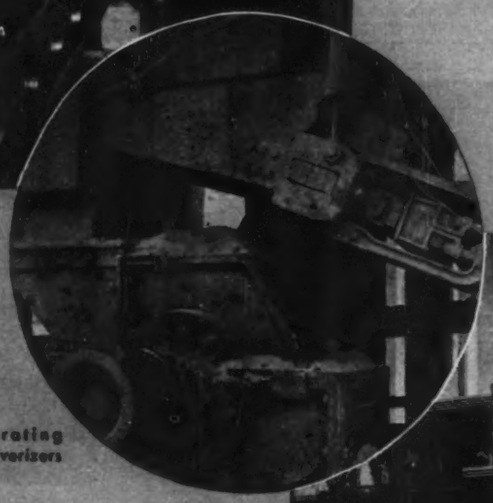
These days, you have to watch out what you say.

FOR SERVICE THROUGH THE YEARS

Jeffrey MATERIAL HANDLING EQUIPMENT

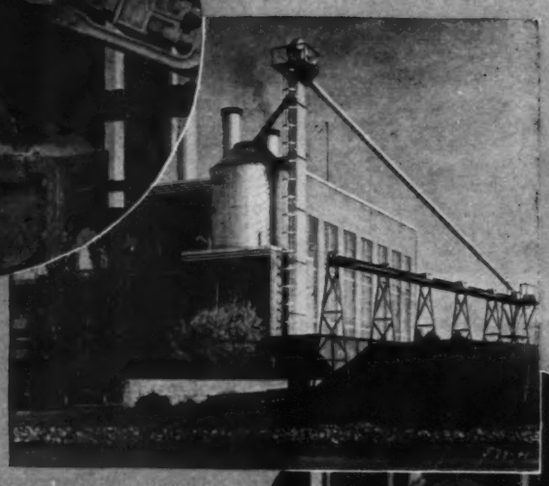
Handling costs are to be found in most unexpected places. The task of detecting all of these, applying remedies and co-ordinating them with the manufacturing scheme, requires specialized skill and experience. Jeffrey has been building material handling equipment for seventy years . . designs almost every type . . some that cannot be obtained elsewhere. Our engineers have built up in these years the experience and skill . . have the resources of devices and material . . to throw wide open a vast source of potential cost reduction. Give us the opportunity to show you.

Steel apron conveyor. (Also wood apron conveyors)

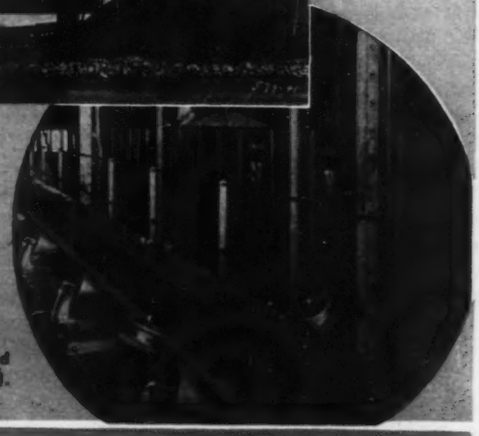


Electric vibrating feeders and pulverizers

FOR HANDLING LARGE QUANTITIES OF BULK MATERIAL. A CONSTANT, UNINTERRUPTED FLOW



Coal and ashes handling — bucket elevators, conveyors, weigh larries, skip hoists, crushers, car pullers, etc.



Belt conveyors (troughed or flat belt types).

THE JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

925 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

JM

Baltimore 1 · Buffalo 2 · Cleveland 13 · Harlan · Jacksonville · Pittsburgh 22
Birmingham 3 · Chicago 1 · Denver 2 · Houston 5 · Milwaukee 11 · St. Louis 3
Boston 16 · Cincinnati 2 · Detroit 13 · Huntington 19 · New York 7 · Salt Lake City 1
· Philadelphia 3 · Scranton 3

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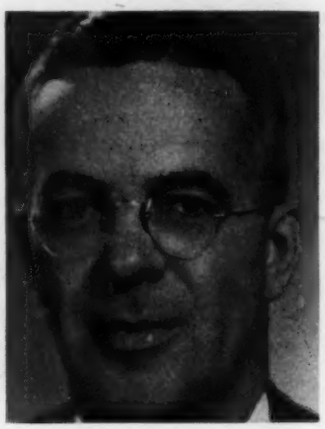
Iron Age Introduces

GEORGE M. FEIEL, comptroller, Republic Steel Corp.

PAUL S. KILLIAN, vice-president in charge of purchasing, Bethlehem Steel Co.



ROSWELL F. CURTIS, eastern area manager of sales, American Steel & Wire Co.

George M. Feiel has been appointed comptroller of REPUBLIC STEEL CORP., Cleveland, succeeding Pearce F. Boyer, who died. Mr. Feiel joined Republic in 1936 as general accountant. He was appointed assistant comptroller in 1941. **Ralph E. Waldo,** who has been assistant to the comptroller, has been promoted to assistant comptroller. He has been with Republic since 1941.

Stuart D. Goulding has been named to the newly-created post of director of public relations, YOUNGSTOWN SHEET & TUBE CO., Youngstown. Mr. Goulding had previously been associated with Rheem Mfg. Co.

Robert Penovich has been appointed purchasing agent of the CLEVELAND CHAIN & MFG. CO., Cleveland. Mr. Penovich had formerly been connected with Wilson Foundry & Machine Co.

Paul S. Killian has been appointed vice-president in charge of purchasing, BETHLEHEM STEEL CO., Bethlehem, succeeding Charles R. Holton, who died. Mr. Killian joined Bethlehem in 1917. He became purchasing agent of the company in 1944.

Eugene Mowlds, Jr., has been appointed assistant to vice-president, AMERICAN BRIDGE CO., Pittsburgh. Mr. Mowlds had been serving the company as contracting manager in Philadelphia. **James C. Hamilton** has been named to succeed Mr. Mowlds there. Mr. Hamilton joined the company in 1937 and was named assistant contracting manager at the company's Cleveland district office in 1946.

Oscar C. Maier has been appointed director of research, PULLMAN-STANDARD CAR MFG. CO., Chicago. Col. Maier recently resigned from the engineering division of the U. S. Army Air Forces at Wright Field, Ohio.

Roswell F. Curtis, Howard B. Maguire and **Clarence T. Gilchrist** have been named to newly-established posts of area managers of sales, AMERICAN STEEL & WIRE CO., Cleveland. Mr. Curtis, who joined the company in 1920 and who has been manager of the manufacturers products sales division since 1945, has been appointed to the eastern area, with headquarters in New York. Mr. Maguire joined the wire company in 1919 and has been sales manager at Detroit since 1933. He has been assigned to the central area with headquarters in Cleveland. Mr. Gilchrist started as a cashier's clerk with the company in 1907, entering the sales department in 1913. He was appointed Chicago sales manager in 1937 and in 1945 was made assistant general sales manager for the Chicago district. He has been appointed to the western area with headquarters in Chicago. **Norman M. Sted,** who has been with American Steel & Wire since 1926,

CLARENCE T. GILCHRIST, western area manager of sales, American Steel & Wire Co.

C. W. HEFLIN, manager of sales, Triangle Steel Co.

HOWARD B. MAGUIRE, central area manager of sales, American Steel & Wire Co.

becoming assistant manager of the manufacturers products sales in 1943, has been appointed manager of the manufacturers products sales division in Cleveland. **Maxwell D. V. Millard,** who joined the New Haven works of the company in 1934 and who has been assistant manager of sales at Detroit since 1947, has been named manager of the Detroit district sales office. **Edward A. Murray** has been appointed manager of the Chicago district sales office. He has been employed by the company since 1934 and in 1945 was made manager of the manufacturers products sales department in Chicago.

A. D. Forbes has been made manager of general engineering for the Atomic Power division of WESTINGHOUSE ELECTRIC CORP., Pittsburgh. Mr. Forbes had been manager of the customer order section in distribution transformer engineering since 1945.

Thomas F. Dorsey, who has been general manager of Fort Pitt Steel Casting Div., has been elected president of PITTSBURGH STEEL FOUNDRY CORP., McKeesport, Pa. Mr. Dorsey has been a vice-president of the corporation since 1947. In 1948 he assumed the duties of general manager of the Glassport Foundry as well as Fort Pitt. He has had extensive experience in the steel casting industry, having served in various capacities at Fort Pitt for many years, including ten years as sales manager, and also as a member of the executive committee for a number of years. Mr. Dorsey continues to have his offices at Glassport and McKeesport, Pa.

H. L. Bradbury has been appointed to the newly-created position of manager of railway sales for the ELASTIC STOP NUT CORP. OF AMERICA, Union, N. J. Mr. Bradbury joined the production department of ESNA in 1941 and transferred to the sales staff of the company in 1943.

John R. Kingman has been appointed sales manager of the railway division of NATIONAL MALLEABLE & STEEL CASTINGS CO., Cleveland, with offices in Richmond, Va., succeeding **William Blackmore,** who has retired after 43 years of service. Mr. Kingman joined the engineering department of National at Cleveland in 1946 and was subsequently transferred to the St. Louis office as a field engineer. He has been assistant manager of sales of the railway division since 1947. Mr. Blackmore has served the company since 1906 in many capacities. In 1945 he was made sales manager of the division in Richmond.

C. W. Heflin has been appointed manager of sales of the TRIANGLE STEEL CO., Los Angeles. Mr. Heflin had formerly served as assistant sales manager of the Los Angeles division of Columbia Steel Co.

W. Reed Morris has retired as vice-president and general manager of the gas and coke division of KOPPERS CO., INC., Pittsburgh, after 34 years with the company. Mr. Morris, whose headquarters had been in Kearny, N. J., continues to act as a special consultant to the gas and coke industries, with his office in New York. **Myron T. Herreid** has been appointed to succeed Mr. Morris as vice-president and general manager. Mr. Herreid joined the company in 1922 and has been a vice-president in the Koppers division since 1940. **K. R. Hare** assumes the duties of eastern representative of the entire Koppers Co., succeeding Mr. Morris. Mr. Hare now becomes the chief administrative officer for the company in the New York-New Jersey area. He continues as manager of the Seaboard coke plant. Mr. Hare joined Koppers in 1928.

Mark C. Simpson has been appointed Pennsylvania division sales manager of TEMPLETON, KENLY & CO., Chicago.

A. F. Mack has been appointed eastern sales representative by THOMAS MACHINE MFG. CO., Pittsburgh. Mr. Mack, who has been employed in a production capacity since 1942, maintains his headquarters in Philadelphia, servicing the territory from Connecticut to Virginia.

Turn to Page 122

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LOOK INTO CMP THINSTEEL

THINSTEEL reduces finishing costs

Thinsteel users are demonstrating daily that buffing an polishing operations can be eliminated entirely or sub stantially reduced when fabricating CMP bright annealed chrome-nickel stainless strip—an exclusive CMP produ . . . Chromium and nickel platers have proven that CM carbon strip with the carbide-rolled #3 finish plates fast and better . . . Fabricators using CMP electro zinc coate Thinsteel know it will draw and form without flakin and hold enamel or paint without blistering or peelin

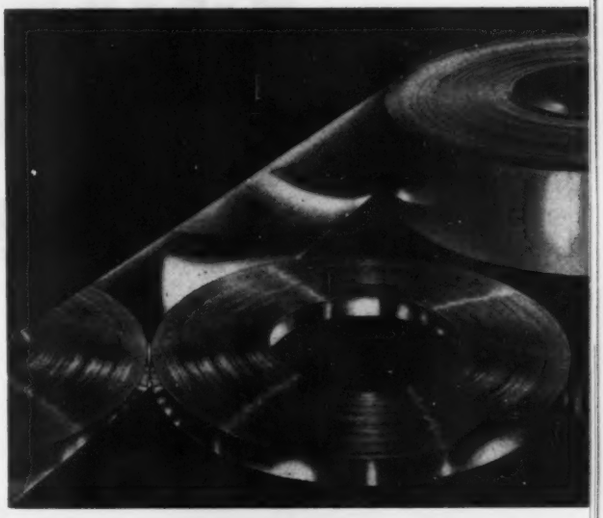
THINSTEEL increases yield

Close gauge tolerance is the secret. The closer to gaug the more feet per pound of metal and the more parts p ton. Similarly, the closer to gauge the less wear on di and thus longer die life and less down-time. Case histori show 15% more parts per tool grind on complicate forming and drawing operations.

THINSTEEL "extras" at no extra cos

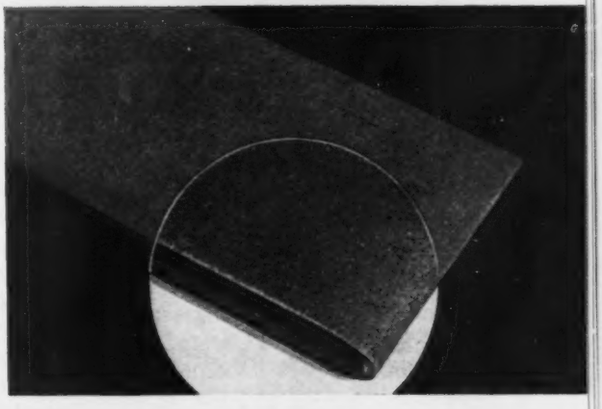
Typical of CMP "plus values," which cost no more tha ordinary run-of-mine strip steel but which mean mo press and machine hours of actual production service, a CMP extra long coils—up to 300 lbs. per inch of width cutting shutdown and changeover lost time to a minimu

FOR LOWER FABRICATING COSTS



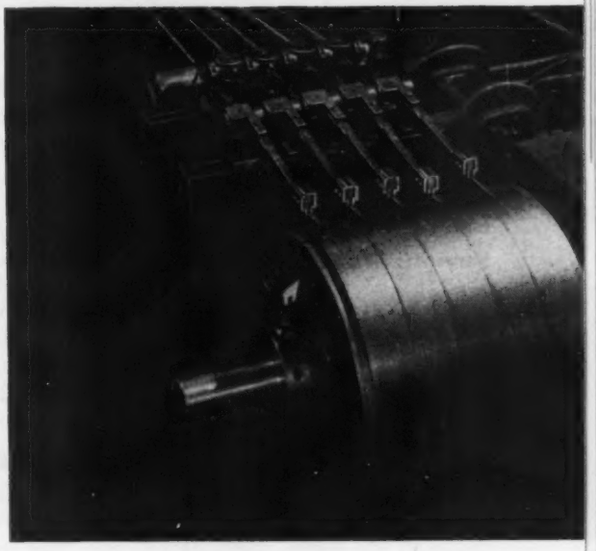
18-8 BRIGHT ANNEALED STAINLESS STEEL

CMP'S exclusive development of the chrome-nickel bright annealing process offers 18-8 and similar stainless analyses in dead soft tempers for easy fabrication *but* with gleaming bright mirror finish that eliminates or substantially reduces costly finishing. Bright annealed Stainless Thinsteel is available in gauges as thin as .001".



ELECTRO ZINC COATED STRIP STEEL

The CMP electro zinc coating process deposits a dense, fine grain, high-purity zinc coating which withstands punishing fabricating operations without flaking or injury. This product can also be furnished chemically treated to insure dependable paint or enamel adherence. Gauges .001" to .050"; widths 3/16" to 24".



USE FRACTIONAL WIDTHS?

Put more steel on your reel

CMP Thinsteel in fractional-inch widths can be supplied in oscillated-wound coils containing several times the footage practical with ordinary ribbon-wound coils. This CMP developed coiling procedure makes it possible for you to radically reduce machine shutdown periods for coil replacement when fabricating narrow strip.

the Cold Metal Products co.
YOUNGSTOWN 1, OHIO

NEW YORK • CHICAGO • DETROIT • ST. LOUIS • INDIANAPOLIS • LOS ANGELES

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PUBLICATIONS

New publications that describe money saving equipment and services are available free and without obligation. Copies can be obtained by filling in the attached card and mailing it.

Soluble Oil Bases

Six-page folder describes soluble oil bases and contains a discussion of the purposes and requisites of such oil bases. The product described is a stable, non-skinning, non-gumming base of selected petroleum sulphonates plus secondary emulsifiers. *Pennsylvania Refining Co. For more information, check No. 1 on the postcard.*

Metal Stampings

Small lot metal stamping service which provides low die costs is described in an 8-page bulletin. This type of service is of value in experimental and development work, limited output manufacture, improvement or changes on existing products and in many other ways. *Dayton Rogers Mfg. Co. For more information, check No. 2 on the postcard.*

Screen Data

Condensed conversion data for punched screen plate, wedge wire screen and screen wire mesh may be read from small, pocket size slide table. Data is correlated for inches, millimeters, U. S. Wire Mesh and Tyler Wire Mesh, and each measure can be converted to decimal inches and microns by means of the slide. *McNally Pittsburgh Mfg. Co. For more information, check No. 3 on the postcard.*

Volt-Ammeter

Pocket size volt-ammeter of the split core type is described in catalog No. 109. This instrument, designed for use by maintenance men, engineers, electricians and mechanics, is 7 in. long, weighs one lb, and measures current without breaking circuit. *Pyramid Instrument Co. For more information, check No. 4 on the postcard.*

Traveling Cranes

New and improved features are covered in a brochure on electric traveling cranes. Among these features are fluid drive through the use of hydraulic couplings, full vision cab for the operator who has unobstructed view of 246° of arc, and magnetic control over operation of crane. *Whiting Corp. For more information, check No. 5 on the postcard.*

Midget Mills

Catalog lists and describes various types of miniature milling cutters which are available in a number of shapes and contours. Included are lab mills, carbide mills, internal and external deburring mills, tube chamfering mills, reamers, edging mills, die mills, and other milling tools. *Severance Tool Industries, Inc. For more information, check No. 6 on the postcard.*

Power Drivers

Bulletin describes power drivers to drive steel studs into steel, concrete or masonry. Drivers use a unique integral cartridge assembly whereby accidental discharge of cartridge is impossible, have a wide working range and are fast and economical to operate. *Mine Safety Appliances Co. For more information, check No. 7 on the postcard.*

Perforated Sheet

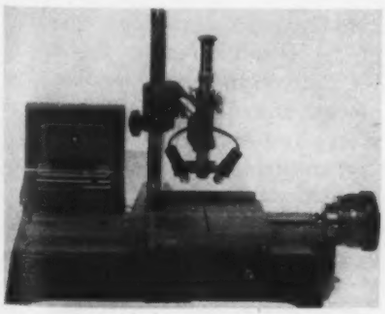
Sheet stock of various types are illustrated in a folder which also lists embossed aluminum sheet. Square, rectangular, round, elliptical and triangular perforations, in any combination, and in any arrangement may be had from stock or special designs in brass, steel, zinc, stainless, plastic and aluminum. *Erdle Perforating Co. For more information, check No. 8 on the postcard.*

Improved Dust Collector

Recent improvements in Model 420 Dustkop dust collector permit its use on polishing, buffing, and grinding operations involving larger wheels and bigger volumes of dust. The unit has increased suction with no increase in overall size. New ratings, due to the combined use of a 1/3 hp motor direct driving a new special hi-static paddle wheel fan, and based on actual instrument tests are: 437 cfm on a 4-in. inlet pipe; static suction of 3.2 in. water with a velocity of 7300 fpm developed with a 3-in. inlet pipe. The cyclone separator that is built into the unit and the second stage filter of spun glass that gives the air a final cleaning before returning it to the working space are both continued in this model. *Aget-Detroit Co. For more information, check No.* 9 *on the attached postcard.*

Measuring Microscope

Designed primarily for use in the mold and toolroom, a new measuring microscope features a 10¼ in. range of stage travel. Large die blocks and molds can be placed on the stage and overhang considerably. Weights to 100 lb or more are accommodated, it is reported. Height under objective is 10 in., allowing determinations to be made on objects 8¼ in. high. Measurement is said to be accomplished quickly and accurately with



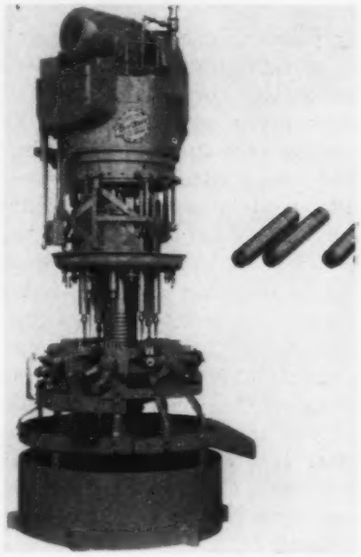
simple determinations taking about 1 min., and extended range measurements taking 2 min. or more. The stage is traversed back and forth by hand, bringing two measurement points on the workpiece successively under objective. They are then both located along the axis of motion of the stage and are ready for measurement. Direct readings are of 0.0001-in. accuracy. The micrometer head is accurate to 0.000025 in. Overall magnification is about 32X. *Boeckeler Instrument Co. For more information, check No.* 10 *on the attached postcard.*

Absolute Pressure Gage

The principle of a mechanical-type recording absolute pressure gage involves a pressure-sealed lever arm so constructed that it is frictionless, free from lost motion, and free of turning moments due to changes in differential pressure across it. This design makes possible the recording of extremely low absolute pressure ranges. The new instrument is offered in ranges from 0 to 20 mm mercury up. It is rugged in construction and can be used under ordinary plant conditions. The instrument is offered as a recorder, an automatic controller and for remote measurement and automatic control of absolute pressure. *Bristol Co. For more information, check No.* 11 *on the attached postcard.*

Vertical Driller

Change gears for governing both cycling time and spindle speeds are found on the Rotomatic SV vertical continuous drilling machine. The machine reams two sizes of intake and exhaust valve guides, the larger having a hole 5/16 in. diam x 3¼ in. long. Eight 20-station automatic indexing type fixtures are mounted on the eight spindle machine. After stations of the loading magazine are filled with valve guides, the machining and ejection cycles are automatic. Any number of stations up to the full 20 can be loaded at any point in the cycle of the machine. As the fixture passes the loading station, the loading magazine indexes and the valve guide drops through to a stop where it is located in a V and clamped by a sliding jaw. The reamer is then fed through the workpiece by a feed cam while the table rotates. Upon completion of reaming the spindle retracts and



the valve guide is unclamped automatically, passing into the ejection chute. A production of 2520 pieces per hr is reported. *Davis Thompson Co. For more information, check No.* 12 *on the attached postcard.*

Carbide Scriber

Tungsten carbide brazed into a core extending from the tip of a steel handle comprises a new tool for scribing clean lines on tool bits, hardened steel, chromium, stone, or glass. The Scriber is equally useful on rusty repair work, and cleanly penetrates hard scale on boiler plate. A newly designed vertical and horizontal knurl provides an easy grip for the 5-in. shank. *Niagara Instrument Corp. For more information, check No.* 13 *on the attached postcard.*

Straightening Presses

Straightening large weldments, structural shapes, forgings, castings and plates without moving the part once it is positioned on the press bed is possible on new two-way, all-hydraulic straighten-

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NEW

PRODUCTION IDEAS

Continued

ing presses. The ram assembly is the moving unit and can be moved horizontally or transversely to cover every square inch of the pressing area on the bed. A single hand lever controls both movement and speed of the straightening ram. The press is equipped with an H-P-M oil hydraulic power unit with a variable delivery H-P-M radial piston pump and an electric motor drive. Two models have capacities of 200 and 400 tons; ram facing of 13⅜ and 19¼ in.; beds 192 x 48 in. and 192 x 82 in. Ram travel is 18 in. max. *Hydraulic Press Mfg. Co. For more information, check No.* 14 *on the attached postcard.*

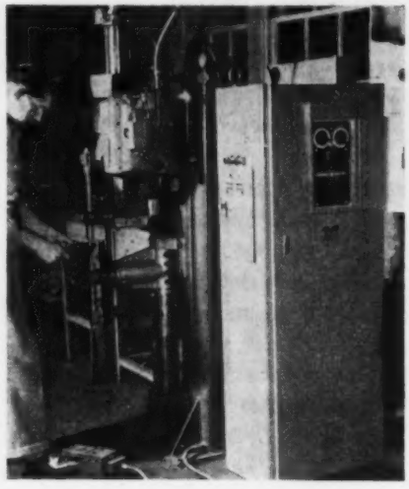
Threading Machine

Threading, trimming, beading, knurling and curling, either as separate operations or in combination, are possible on a new machine that handles material up to 3/32 in. thick. In producing the con-

tainer illustrated, parts are placed in a chute by the operator, and are fed automatically to the chuck, threaded, and ejected at the rate of 35 per min. By an interchange of chucks, the cover is handled with the same sequence of operations. The machine is 4½ ft high x 5½ ft deep x 6½ ft long. It is powered by a 2 hp, 900 rpm motor using a V-belt drive, and is equipped with automatic lubrication. *V & O Press Co. For more information, check No.* 15 *on the attached postcard.*

Resistance Welder Control

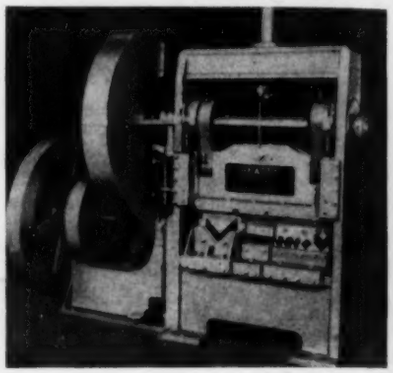
For use as an accessory with single-phase synchronous or non-synchronous resistance welding ma-



chines, a new slope control provides the desirable refinement of a gradual increase in welding current at the beginning of the weld. The control materially reduces tip pick-up in spot welding aluminum and magnesium alloys. Two types are available: one intended for mounting in the side of synchronous controls, the other, in a separate enclosure, for use with older types and non-synchronous control. The operator's panel consists of two dials, and a transfer switch. The setting of one dial, that is graduated from 3 to 13 cycles in one-cycle steps, determines the time for the welding current to reach a final value from its initially low one. The other dial, graduated in per cent of the final current, permits adjustment of the initial value of the welding current. The transfer switch disconnects the slope control. In operation, the slope control functions as a variable resistor placed in series with the heat control rheostat in the standard welding control panel. *General Electric Co. For more information, check No.* 16 *on the attached postcard.*

Bar Shear

Rounds, angles, bars and squares can be sheared without changing tools on the new Guillotine bar



shear. The unit, suitable for either production or short order shearing, provides a 48-in. base for mounting tools that include two sets of angle shears, one shear for handling squares, and shears to handle three sizes of round bars. The machine is available in 50 to 450-ton capacities. *Beatty Machine & Mfg. Co. For more information, check No.* 17 *on the attached postcard.*

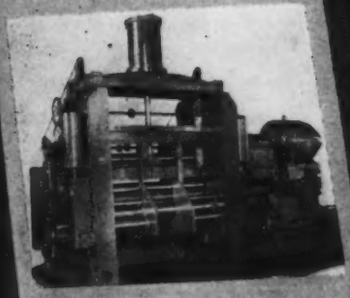
Cycle Arrangements

Two automatic cycle arrangements have been designed to provide the required accuracy of B&S Nos. 5, 10, 12, 20, 22, 23, plain grinding machines, reduce idle time of the machine, require less operator attention, and reduce the amount of spoiled work. The method of the two arrangements in bringing the grinding wheel into direct contact with the work while in operation permits greater tolerances in previous turning operations and gives practically full-time grinding. Specifically, the automatic cycle and spark-timing arrangement assures rapid uniformity of sizing and finish as the spark time is set at a predetermined figure. Spark time is adjustable 2 to 180 sec. When the grinding is completed, the wheel

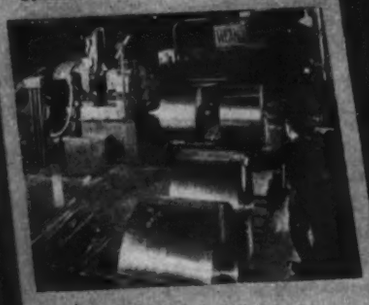
WEAN

Continuous Strip Pickle Line

Processing Uncoiler

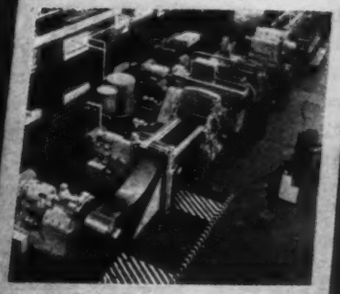


Continuous Electrolytic Cleaning Line

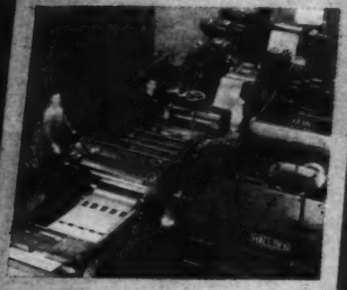


Continuous Hot-Dip Galvanizing Line

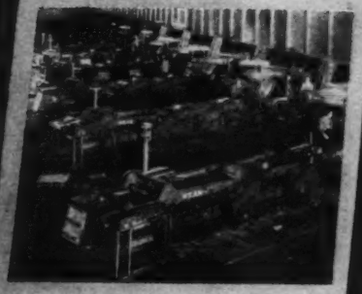
Continuous Coating Line



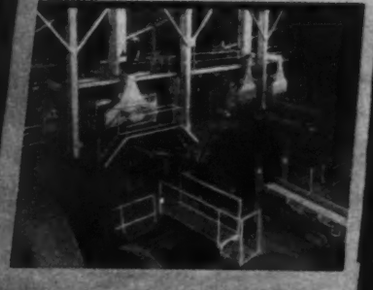
Tin Plate Shearing Line



Hot-Dip Tinning Units



Mechanized Sheet Mill



SPECIALISTS IN SHEET, TIN
AND STRIP MILL EQUIPMENT

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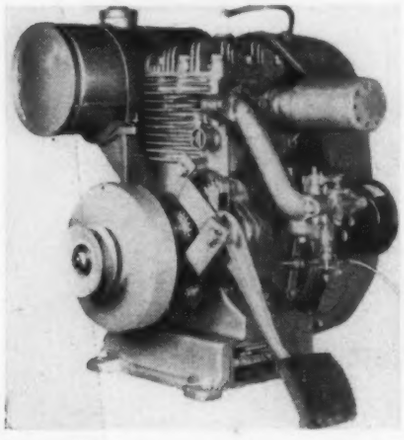
PRODUCTION IDEAS

Continued

slide withdraws automatically, the headstock stops and the coolant is shut off. The work is sized from the machine's accurate cross feed mechanism. The automatic cycle and sizing arrangement sizes directly from the work, eliminating compensating for wheel wear and the effects of wheel truing. After loading, a single oscillatory movement of the cross feed handwheel and placing the sizing gage on the work is all that is required of the operator. The cycle is completed automatically. *Brown & Sharpe Mfg. Co. For more information, check No.* 18 *on the attached postcard.*

Automatic Clutch

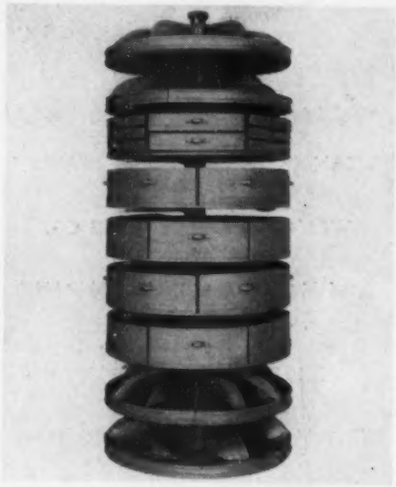
A drum-type, automatic clutch for large air-cooled engines is comprised of a drive flange assembly in which three cast iron shoes pivot and a drum that is faced with an internal molded lining. The drive



flange is keyed to the engine crankshaft and, when driven, the shoes throw radially outward by centrifugal force to engage the drum. Extension type springs delay the engagement of the clutch until the engine has accelerated to 1450 rpm, the clutch becoming fully engaged at 1750 engine rpm. Clutches are available with 12-tooth No. 40 chain sprocket, B section V pulleys, or suitable for the welding on of special adapter equipment. *Cushman Motor Works, Inc. For more information, check No.* 19 *on the attached postcard.*

Revolving Storage Bins

Circular bins for storing parts and tools feature revolving disks set on ball bearing assemblies.



These disks easily rotate independently in either direction. Disks may have permanent compartments, bolt-less removable bin fronts, or adjustable dividers. Removable drawer units are individually housed and provided with a backstop to prevent dislodging from the housing. The units have a circular cast iron base attached to a heavy tubular steel stem. A variety of models combine adjustable dividers, drawer units and pans for specific requirements. *Universal Steel Equipment Corp. For more information, check No.* 20 *on the attached postcard.*

Low Melting Solder

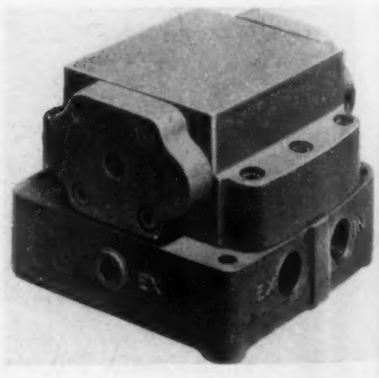
Low melting solder in ribbon form is ⅜ in. wide and is flux containing. The amount of solder is placed where wanted and heat is applied with an ordinary match or a soldering iron. The resulting connection is said to offer the maximum of neatness, strength and penetration. *Proved Products Mfg. Co. For more information, check No.* 21 *on the attached postcard.*

Steel Shot

Development of Tru-Steel shot for use in blast cleaning equipment has been announced. The new material is a genuine true steel that has received a full heat treatment and exhibits a combination of hardness and toughness. The useful life of the shot is said to be longer than that of chilled iron and it cleans as fast. True-Steel wears down and does not break down; there is no possibility of fragments imbedding in soft work. Other advantages are reduced wear on the blast cleaning equipment and lower cost per ton. Tru-Steel shot is available in all sizes. *American Wheelabrator & Equipment Corp. For more information, check No.* 22 *on the attached postcard.*

Four-Way Valve

Few fittings are needed in a new four-way Mastair valve of the balanced spool type, because of straight line piping. The valve is



controlled by one four-way or two three-way pilot valves. Pipe may be connected to bottom or sides, and parts may be removed without disconnecting pipe. Spool and sleeve assembly is easily taken out by removing end caps. Parts are interchangeable in any size. Capacities of ⅜, ½, ¾, and 1 in. are of fully rated pipe size. Control

(Turn to Page 134)

ANNOUNCING

REVERE ALUMINUM STRIP

IN order to serve more fully your needs for aluminum alloys, Revere Copper and Brass Incorporated has established a new mill for rolling aluminum strip.

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On the ASSEMBLY LINE

AUTOMOTIVE NEWS AND OPINIONS

New Buick 40 represents latest work of General Motors stylists and engineers . . . Bumper-grille is made of heavy steel to give added strength.

by Walter G. Patton

Flint—The new Buick 40 series announced here this week will not be referred to as a 1950 model but only as the new Buick 40 or Special. However, as the newest car in the GM family it embodies the most recent engineering and styling innovations Buick engineers, Fisher Body engineers and the corporation's styling section have been able to invent.

The new car is well worth a detailed examination to determine the styling and engineering trend GM is likely to follow in its new 1950 cars to be introduced later this year.

It should be remembered, of course, that each GM division—and particularly Buick—retains many individual characteristics. It is expected that some of the newest features of the 1950 cars will be found on this latest Buick model—and some on this model exclusively.

GM Builds in Canada

Detroit — General Motors will build a diesel-electric locomotive plant in Canada. Options have been obtained on a 210-acre tract of land at London, Ont., where a 226,000 sq ft plant will be built by GM Diesel, Ltd. Construction is to begin immediately. The plant will employ about 1000 persons.

A GM spokesman pointed out that according to the April 1949 Interstate Commerce Commission power reports, diesel locomotives are supplying 47.5 pct of the U. S. yard switching hours, 31.5 pct of the freight gross ton miles and 47.5 pct of the passenger train car miles.

E. V. Rippingille, Jr., formerly manager of Plant No. 2, General Motors Electro-Motive Div., near Chicago, will be president and general manager of the new GM subsidiary.

Each of the three new Buick models is a so-called fastback or streamlined body type. If there is to be a notch-back model Buick 40—and this seems to be the most popular body style in other GM lines—this model will be added later.

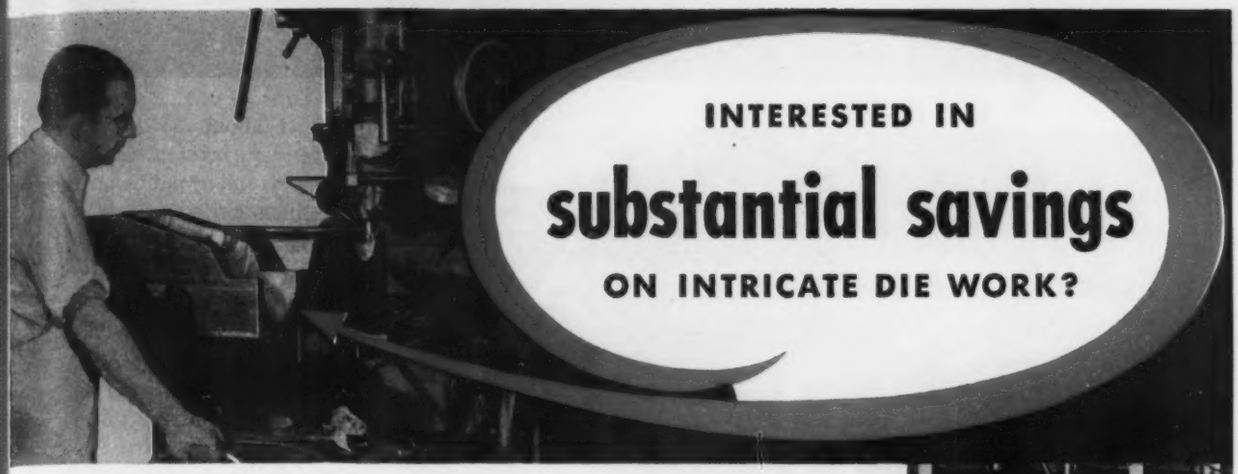
The new cars are mounted on a chassis that is ½ in. longer than the previous wheelbase. However, through the use of a new bumper-grille, the overall length of the car has been decreased 3½ in.

Buick engineers say the new cars have more head room than the previous models. The new bodies are also wider, especially at the rear seat line. Passengers sit farther ahead of the rear axle.

Design Improvements Made

A number of structural and engineering improvements have been made, including many redesigned structural body members to increase rigidity and reduce weight. Several new insulating and anti-corrosion practices have been adopted, especially rustproofing that will prevent or minimize corrosion that starts on the inside of the body.

The body is all-welded steel construction using channel-type reinforcements and a number of double-walled sections. By carrying the box-section construction to the roof rails and extending this design from the top of the windshield to the rear quarter panel, narrower windshield pillars can be used without sacrificing structural strength. A narrower body center pillar is also speci-



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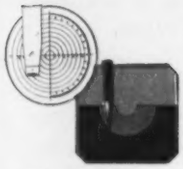

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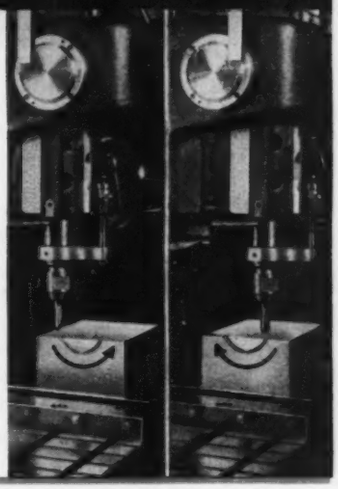

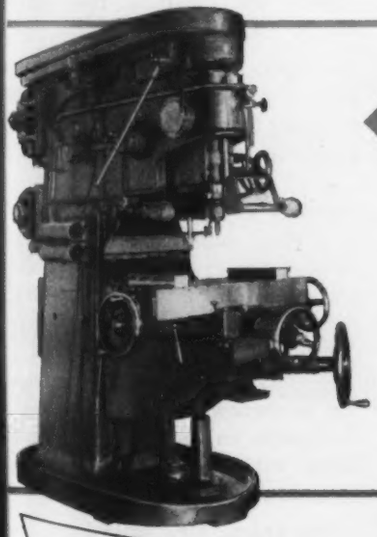

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ILLUSTRATED BULLETIN ON BOTH MACHINES

The features of two models of P&W Plain Die Sinkers, and two models of P&W Universal Die Sinkers are fully described in this Bulletin. Simply drop us a card for your copy; there's no obligation.

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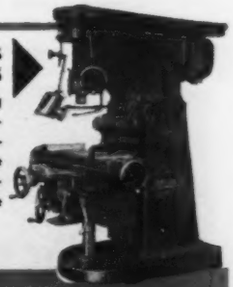
Modern engineering design and P&W Precision make these machines ideal for die shops where the majority of cuts are straight.



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DIE SINKERS

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BUICK'S NEW BREADWINNER: Largest volume car in the Buick line is this new Buick Special, introduced this week. The Special which has been out of production since January is expected to account for 50 pct of all Buick output. The new car breaks with GM tradition in several respects.

fied and the opening for the rear window has been enlarged.

Undoubtedly the most talked about feature of the new Buick—and the construction that is most likely to be imitated—is the new front bumper-grille. The bumper is one-piece wrap-around type. In addition to two large bumper guards in which parking lights and direction lights are concealed, there are nine verticle bumper grille bars. These are bolted individually to the bumper. The bars are of heavy steel stock and obviously much more resistant in the event of an accident than a diecasting or 20 gage steel, chromium plated. Lenses mounted in the bumper guards are plastic and are readily replaced according to Buick engineers who insist they are not vulnerable in their new location.

Buick Designers Cut Costs

Buick designers have obviously taken steps to cut costs on the new models wherever possible. The instrument panel control catch for the bonnet or hood has been replaced by an outside release by means of a key. (A large screwdriver will do if you lose the key.) Chromium trim around the front windshield and the rear window has been eliminated. Side chromium trim has been eliminated except around the windows. Curb weight of the car has been reduced about 35 lb. There are no fender inserts to cover the wheels (fender pants as they are sometimes called).

Windshield area has been increased 48 pct and the rear window glass area is 56 pct larger than the previous models.

Buick is using a steel wheel cover fitted into the circle formed by the outer flanges of the wheel to carry its spare tire. As in most of the fastback type cars, the rear luggage space is smaller than in other model types.

The rear compartment trunk lock is a combined emblem and locking mechanism. The cover lifts up by merely turning a key; it is not necessary to turn a handle. The cover locks by slamming. Push button type door handles are specified as on other GM cars.

A limited number of changes have been made in the engine.

Speed of the fan has been reduced for quieter operation. To offset the reduced speed, fan blades have been widened.

On cars equipped with Dynaflow drive, the frontal area of the radiator has been increased from 419 sq in. to 484 sq in.

Some Engine Changes Noted

Engine compression ratio for Series 40 cars using standard transmissions is 6.3 to 1. Where the Dynaflow transmission is ordered, a compression ratio of 6.9 to 1 will be used. This increases the horsepower from 110 to 120. Hydraulic valve lifters and an oil filter will also be included on Dynaflow cars.

The frame side rails have been reinforced and extended forward to provide a stronger mounting for the heavier bumper-grille. The center of the frame X-member has been moved 4 in. toward the front wheels and the front cross members have been redesigned to accommodate the new body floor. The basic design of the frame is about the same as earlier models although the new frame is practically all-welded construction.

EVERYTHING BUT THE KITCHEN SINK: Kaiser-Frazer's new utility sedan, the Kaiser Vagabond, has a double hinged rear door which opens into 130 cu ft of interior cargo space when the seat cushions are folded out of the way. Carrying space is 10 ft in length, almost equal to the Vagabond's 123½ in. wheelbase. If desired, the rear seat can be folded into place in a matter of seconds, converting the car into a family sedan.

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THE FEDERAL VIEW

THIS WEEK IN WASHINGTON

Government agencies submitting their views on the Hoover Commission recommendations . . . New materials of construction necessary for atomic research work.

by Eugene J. Hardy

Washington — During the past month the various agencies of the federal government have been submitting their views on the reports of the Hoover Commission on reorganization of the government to the Senate Expenditures Committee. Since the bipartisan group headed by former President Herbert Hoover completed its monumental task a few months ago, the grass roots reaction has been favorable. The tax-burdened public has looked forward to the money savings that could result from reorganization of the cumbersome and wasteful federal structure. Congress has lauded the work of the Commission and speedily enacted legislation giving the President authority to reorganize the federal government. President Truman acted swiftly and submitted seven reorganization plans to Congress, which will become effective Aug. 20 unless rejected by either House.

But, Sen. McClellan, D., Ark., chairman of the Expenditures Committee, decided to learn the views of the various agencies, bureaus, and commissions on the reorganization proposals applying to their own little segments of the huge federal bureaucracy.

Surprisingly, a large number of the agencies went down the line for the Hoover Commission recommendations. For example, the Attorney General stated that he favored the specific recommendations concerning the Department (Justice). The Commerce Dept. strongly endorsed the recommendations of the Hoover Commission. The acting chairman of the Federal Communications Commission stated that the Hoover Commission has made a considerable contribution.

Hoffman Praises Report

ECA Administrator Paul Hoffman praised "the general organizational concepts . . . with regard to foreign affairs." Other agencies such as the State Dept., Federal Security Agency and Civil Service Commission expressed general approval of the Hoover proposals, but suggested specific reservations.

On the red side of the ledger, however, a large number of agencies, largely those whose functions would be limited, transferred or abolished if the Hoover proposals are adopted, squealed like stuck pigs. Their comments to Sen. McClellan were not unexpected and they can be expected to fight any changes in their organizational structure to the bitter end. Included in this group are the Federal Power Commission, Federal Trade Commission, Federal Deposit Insurance Corp., Veterans' Administration, Housing and Home Finance Agency, National Advisory Committee for Aeronautics, and Selective Service System.

However, most of these dissenting replies were couched in language befitting a response to a duly-constituted Congressional Committee. The Reconstruction Finance Corp. came up with something new, however, in as arrogant a reply as has been seen on Capitol Hill in some time. This agency, whose billion-dollar operations are of vital concern to business and industry, "expressed vigorous dissent to every specific recommendation of the Hoover Commission which applied to the Corporation," according to Sen. McClellan.

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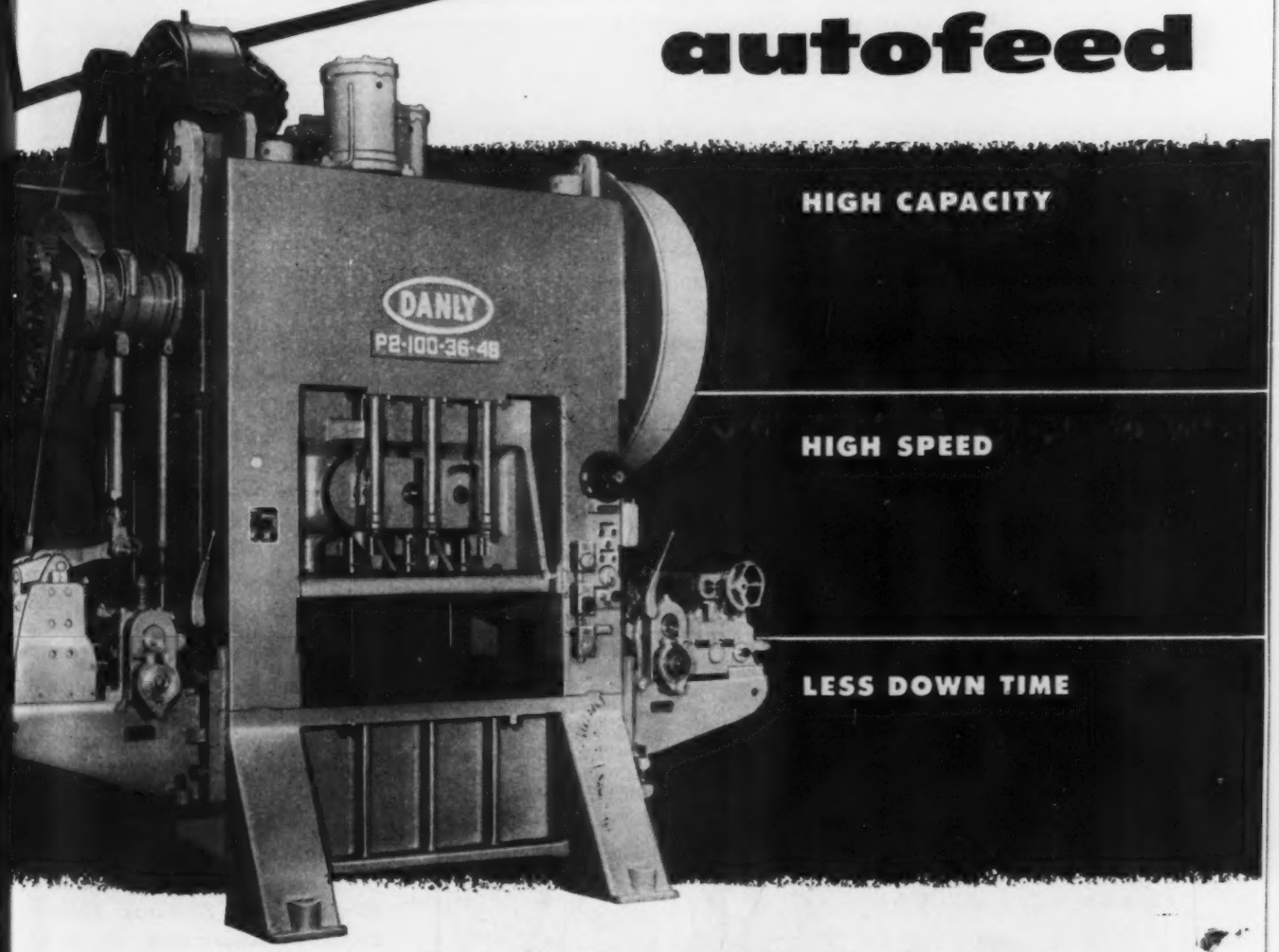

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RFC was also the first agency to attack the Hoover Commission's motives as well as its authority to delve into all phases of Federal activities, which was specifically sanctioned by Congress. In this connection, RFC expressed regret that the Hoover Commission "has departed the field of organization and has entered the controversial field of political economy with its own particular philosophy of the kind and type of service the federal government should provide."

RFC Attacks Commission

A reorganization plan which did not touch on the kind and type of federal services would hardly be worth considering, and this comment has won no friends for RFC on Capitol Hill.

The Hoover Commission recommended that the Secretary of the Treasury should have supervision of RFC operations. RFC says this would be bad and invokes the strange logic that the department which takes in the federal billions and one dispensing billions have no place in the same organization on the grounds that "the broad social and economic purposes served (by RFC) will be impaired."

In as puzzling a move as has been made in Washington in a long time, RFC also objected to the Commission's recommendation calling for Congressional review of the power to make direct loans. Objections were also made to suggestions for restricting direct loans to nonemergency periods. Nor does RFC like the idea of substituting loan guarantees for direct loans.

AEC Needs New Materials

While noting progress "toward finding new materials for construction and shielding of power reactors," the Atomic Energy Commission has reported to Congress that more exact knowledge of metals and alloys must be obtained before the problem of high temperatures and neutron bombardment encountered in power reactors can be solved.

In addition, the creep factor of metals normally efficient in engineering work is believed to be affected by radiation, and consequently the search for new metals and alloys continues. Due to fairly heavy neutron absorption, high temperature steels containing chromium, nickel, molybdenum, and cobalt are undesirable in any quantity in a reactor, according to AEC. Consequently, new materials for structural use at high temperatures must still be developed, for as the Commission points out, much more knowledge of metals is needed before the precise effects of radiation can be evaluated.

Another problem still defying solution results from the corrosion caused by the use of liquid metal coolants, important in keeping operating temperatures within bounds and in transmitting heat from a nuclear reactor to a thermal power producing unit.

Research Assistance Needed

In seeking a solution to these problems, which indicate that practical power from atomic energy is still many years off, AEC expects genuine assistance from outside unclassified research. The metallurgical projects supported by the Commission at the present time seek primarily fundamental knowledge of metals in the solid state.

For example, at Massachusetts Institute of Technology, Carnegie Institute of Technology, General Electric, and Sylvania Electric Products, researchers are studying the diffusion rates of metals and the mechanism of diffusion, and the internal thermodynamic energies and structure of metal lattices. The University of California is attempting to ascertain exactly how creep in metal occurs and what principles of alloying may minimize it. Other labs are seeking to determine just how the internal thermodynamic energies of metals operate in alloys to create the special properties of the alloy metals.

THE BULL OF THE WOODS — By J. R. Williams

HERE WE HAVE FINE FUTURES FOR YOUNG MEN, BUT NOT FOR TH' KIND WHO ARE MORE INTERESTED IN THE RUNNIN' OF POTATO RACES ON TH' DECK OF AN OCEAN LINER THAN THEY ARE IN WHAT RUNS TH' SHIP!
M-M--A GUY WHO CAN AFFORD TO TRAVEL ON ONE O' THEM PALACES DON'T NEEDA WORRY ABOUT ENGINE ROOMS, WOULD HE?
TH' TROUBLE WITH TH' GUYS WITH TH' QUICK COMEBACKS IS THAT HE'LL NOT COME BACK HERE AGAIN!
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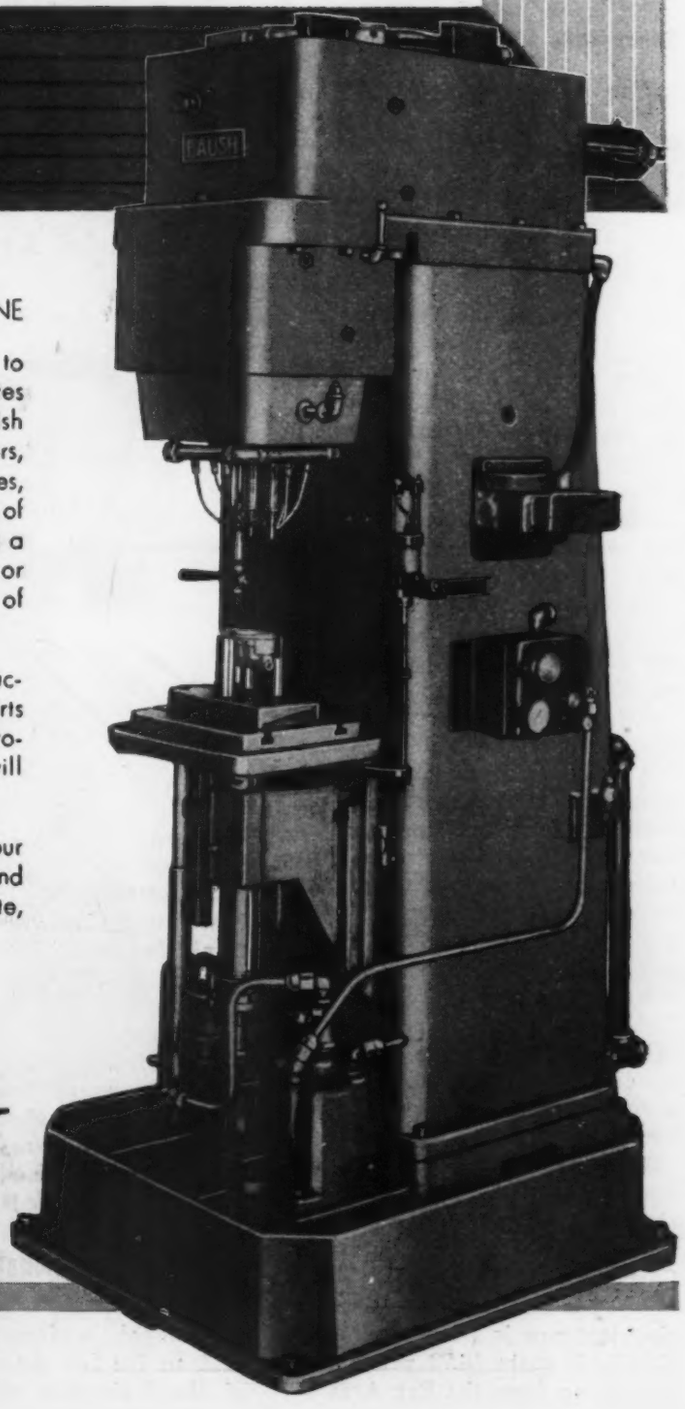

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Wherever tapping is required — in light production — electrical appliances, plastics, small parts and sundry other fields — this new Baush Hy-Production Vertical Leadscrew Tapping Machine will tap out new economies at high speed.

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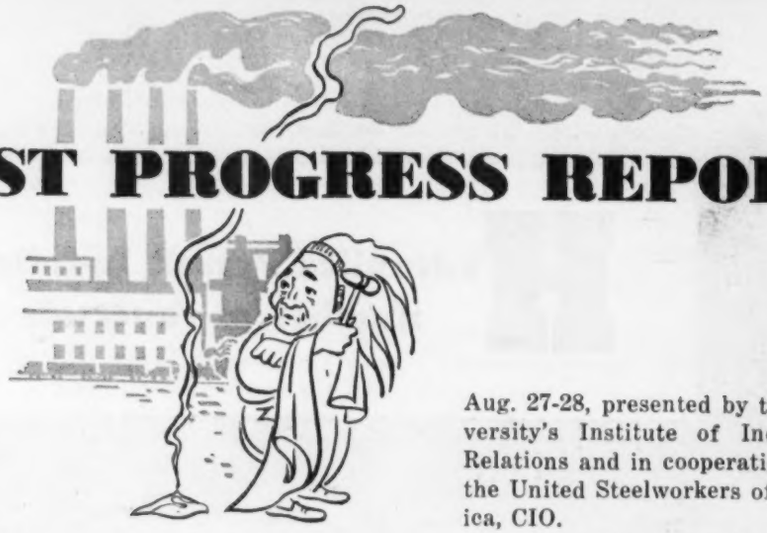
WEST COAST PROGRESS REPORT



Scrap falls $3 in one drop, indicating surplus supply of low cost raw material for Bay mills, fenced by freight rates

Digest of Far West Industrial Activity

by J. Reinhardt

San Francisco — When openhearth scrap falls $3.00 per ton in one leap to $17.00 on No. 1 heavy melting grade, and 6000 CIO warehouse men complete their second month on picket lines in the Bay Area without seriously handicapping distribution and industrial operations, no one can boast of a business boom or sellers' market in central and northern California.

Principal mill buyers of scrap are well supplied and have been for the past several months. Bay Area openhearth operations are currently down to 50 pct and below. Columbia Steel has a long term contract to take over shipbroken scrap, which contract very nearly maintains current inventory. What was a hungry famine not so long ago has become a comfortable surplus, with a freight rate fence around it, so that automobile, railroad, farm and other normal scrap sources may be allowed to simmer and accumulate.

Whereas during the war period it was possible to ship scrap from the Pacific Coast and especially the Pacific Northwest into the Chicago area for slightly over $14.00 per ton, a transcontinental shipment now is at approximately $22.00. It costs $6.72 per ton to ship scrap from the Bay Area to southern California. whereas before the war substantial shipments of scrap were moved from Los Angeles into nothern California for something like $4.00 a ton.

Historically the Bay Area was the firmest scrap market in the Far West, yet currently it is the heaviest surplus area, with no prospect for change until a lot of openhearths and electric furnaces melt up a lot of excellent low-cost scrap now available.

Will Hold Educational Sessions

Los Angeles—A steelworkers' educational conference will be held on the Los Angeles campus of the University of California Aug. 27-28, presented by the University's Institute of Industrial Relations and in cooperation with the United Steelworkers of America, CIO.

Sessions will be devoted to such topics as social insurance, public speaking, community relations and labor procedures. Speakers will include Edgar L. Warren, Arthur Carstens, Irving Bernstein and Robert Tannenbaum of the University's Institute of Industrial Relations, Charles J. Smith and Arnold Campo of CIO, and Walter K. Kingson and Abbott Kaplan of the University's labor-management relations faculty.

Columbia Delays Conversion of West Coast Alcoa Plant

Los Angeles—Apparently watching and waiting on declining building and equipment costs for the right cut to jump into the market, U. S. Steel and its subsidiary, Columbia, have delayed starting to convert the sprawling Alcoa war plant in Torrance near Los Angeles for a cold-rolling mill.

Preliminary announcement, when the aluminum plant was purchased from the government, indicated that construction was to have started several months ago. Many buildings need to be remodeled and others will be moved before the 226 acre plant is suitable for steelmaking.

Although they have made no comment on the delays, spokesmen for the company are firm in their statements that U. S. Steel will go ahead with plans for the mill which will provide a major addition to West Coast steel.

Because of several legal actions before the company was able to purchase the surplus plant

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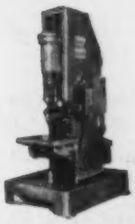
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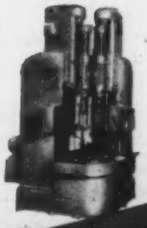

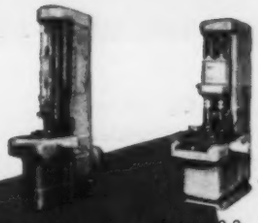

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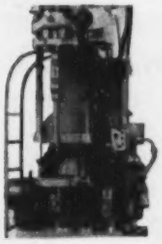
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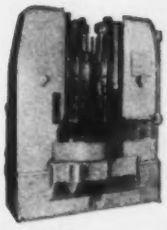
Model 726-3
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Model 818
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Model 718
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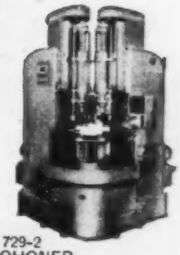
V-8 Multi-Spindle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from the government, estimates on equipment and remodelling changed between the time of original negotiation and of the down payment several months ago. Time was then needed to refigure the job. Meantime considerable has been saved by price drops. Whether or not profits from the eventual opening of the mill would compensate for price drops remains a matter of speculation.

Two of U. S. Steel's largest subsidiaries in this area are operating at full blast despite the changing market. The Torrance mill of Columbia, where sheets, bars, light shapes and merchant items are turned out, was reported last week still at the 100 pct mark. Rival Kaiser Steel at Fontana is operating at about 75 pct. The second U. S. subsidiary, Consolidated-Western has back orders for 30 and 31 in. pipe which runs into 1952. Among the largest current orders is one for Transcontinental Gas which is building a line from east Texas. Kaiser is providing the plate for the pipe.

When work starts on the Alcoa plant, cost of conversion and installation is expected to run close to the $30 million mark. The facilities cost $4,331,000, although the plant was built during the war at a cost of about $25 million. Capacity of the new mill will be 300,000 tons annually.

Among the markets figured to absorb this added West Coast flat steel is principally the automobile, as large enough sheets probably will be turned out for car bodies.

Ends Marine Operations

Portland, Ore.—When Consolidated Builders, Inc. closed down its ship-breaking and conversion operations at Swan Island last week, 7½ years of wartime marine construction and destruction operations came to an end. Before the war Swan Island was a swampy shoal in the Willamette River below Portland with an elemental airport, all owned by the Port of Portland Commission.

For war activities the government took a 10 year lease on the island and the Navy financed a first class drydock. Under war pressure 147 large tankers were completed and 6 others were converted into Navy fleet oilers. During the last 2 years Consolidated Builders, latest leasees, scrapped 45 surplus ships and converted and repaired others. With little new work in sight Consolidated Builders, Inc. considers the job finished and moves on to concentrate on a $28 million contract for the Detroit dam on the North Santiam River and other projects.

Now the Port of Portland Commission hopes to lease from the Navy the steel dry dock capable of lifting 14,000 ton vessels, and from War Assets Administration the other facilities which it owns but on which the WAA still holds a 2½ year master lease.

Kaiser Corporate Family Enlarged by Another Addition

Oakland, Calif.—A proliferous and well developed branch was grafted onto the already vigorous Kaiser corporate tree in place of a top heavy limb as Kaiser Steel Corp. is announced as the new name of what was previously the Iron & Steel Div. of Kaiser Co., Inc. Same officers and organization, all the old facilities and more constantly added, but a new and separate corporate entity.

When an inquisitive genealogist checks up on the Kaiser business family he finds 25 enterprises to reckon with, not to mention any skeleton in any closet. Probably Henry J. Kaiser Co. is the main trunk, wholly owned, and the new Kaiser Steel Corp. is and will be a principal branch, also wholly owned.

Three other big main branches are stock companies, but virtually controlled by Kaiser interest. Permanente Metals Corp., aluminum and alloys, has such satellites as Permanente Products Co. and Permanente Refractories. Permanente Cement Co., cement aggregates and construction materials, has closely associated with it Permanente Steamship Corp., Glacier Sand & Gravel Co. and Standard Gypsum Co. of California. Kaiser-Fraser Corp., international in automobiles, has Henry J. Kaiser Motors as central and northern California distributors.

DIVERSIFICATION: Cellulose acetate envelopes for a Navy chart board are fabricated on a power brake through the use of an electrically heated brake die at Texas Engineering & Mfg. Co., Inc., Dallas. With substitution of different dies, the same basic unit can be used for forming magnesium aircraft parts.

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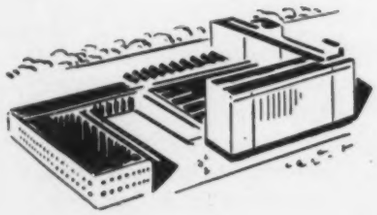

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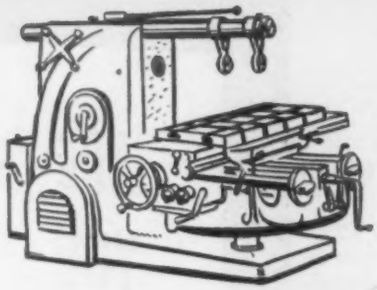

MACHINE TOOL High Spots

SALES, INQUIRIES AND PRODUCTION

by William A. Lloyd

Machine tool prospects appear better for fall . . . Cadillac and Ford changes expected.

Cleveland—An up-swing in machine tool orders this fall appeared to be on the way this week in some of the industry's major sales sectors despite plant vacation periods and other assorted evils that make the summer a seasonal nightmare for many machine tool sales executives.

The signs that herald the fall pick-up, according to trade sources, are these:

Long-standing quotations are beginning to mature into orders. Some of these quotations are a year old, and few can be classed as current. Bulk of the buying is being done by the big companies for new product production. Smaller companies whose finances do not as readily transcend possible fourth round wage increases, etc., are sitting tight.

Quotations on tool and die work have been stiffening in some areas, and considerable interest is being displayed in tool and die shop equipment.

Some of the industries hardest hit in recent months, notably the home appliance industry, are rehiring people and announcing increased production schedules. Business is still spotty, but trade source estimates of July business indicate that June will be the low point for 1949. What the industry is waiting for is a good, integrated replacement program by its major customers.

Detroit Orders Help Outlook

In Detroit, ordering is slow but the potential volume of business continues to be a buoyant factor in the existing situation. A review of some of the reports that are circulating here gives an indication of the comparatively large number of important tooling projects that are under consideration in the Detroit area.

Latest reports indicate the Dodge engine testing program is proceeding even though machine tool suppliers have been asked to hold up quotations previously requested. Indications are that Chrysler is taking another serious look at its most recent engine designs.

A few additional placements of machines for the Borg Warner transmission to be built by Detroit gear division for Studebaker have been reported. A considerable amount of this equipment is being purchased from war assets and other sources, it is reported.

Packard's new transmission production has been held back by engineering changes, according to trade sources. Some new equipment may be required for this project.

Cadillac and Ford Changes

Persistent reports that Cadillac will have an advanced automatic transmission design for its 1950 models have not been translated into extensive purchases of new equipment. Present indications are that Detroit transmission buying will be light and that the plant on Plymouth Road will operate, originally at least, as a feeder plant.

Quotations on additional equipment for Oldsmobile have been reported, the present six cylinder in-line engine is said to be involved.

The Ford rumor crop is even more extensive than usual. V-8 high compression engines, overhead valve sixes, even four cylinder engines have been reported under test but there are no indications at the moment that extensive tooling is being considered for any of these jobs. The most promising Ford programs at the moment appear to be the new Ford press metal shop near Buffalo and a new die casting development which is still only in the preliminary stages.

Strong, Carlisle & Hammond Co., Cleveland machine tool distributor for a number of companies, announced purchase of the former Burke Machine Tool Co. plant in Conneaut, Ohio. J. J. Stephens, president of Strong, Carlisle & Hammond, said his company would move its subsidiary, Strong Steam Specialty Mfg. Co. of Corry, Pa., to the Conneaut plant.

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GLOBAL LETTER

REVIEW OF WORLD MARKETS

Bill to nationalize British steel industry deferred until fall . . . Dorman, Long plans 500,000-ton openhearth shop . . . French seek way to cut manganese ore cost.

London—The Labor government intends to pass the steel nationalization bill with or without the new Parliament Act but an amendment recently added by the House of Lords postponed the issue until Parliament reconvenes this fall. Except for this the House of Commons has rejected all the fundamental amendments made by the upper chamber. Now there is no way to keep steel nationalization from becoming an issue in the coming general election, whether it be autumn or spring. Winston Churchill has declared that the Conservatives would if elected repeal the bill and pit a "full stopper" on all further nationalization.

George Strauss, Minister of Supply, lost no time making the government's position clear when he opened debate in the House of Commons. He was particularly annoyed at those amendments made by the Lords which he said, assumed that the steel corporation would consist of "ignorant busybodies" appointed by an "irresponsible nitwit" of a minister.

At the same time the Conservative party published a policy statement indicating that if it were returned to power at the next general election it would stop nationalization and free iron and steel from the threat of state ownership.

Undertakings which remain nationalized would be decentralized to establish as much local control and responsibility as possible. The railroads would be reorganized into regional systems and new autonomous area boards would be set up for the coal industry. More reliance would be placed on normal trading and less on state buying and control.

Further Nationalization Suggested

Meanwhile the Mineral Development Committee has recommended nationalization of tungsten, lead and zinc ores. Among the committee's recommendations is one that the government pay a guaranteed minimum price for not less than 3 years for tin in order to safeguard future development of the substantial tin ore resources still believed to exist in Cornwall.

Though nationalization talk is neither new nor different it is galling to steel men here right now because they have pushed output beyond the point the planners hoped for. For the year ended June 30 for example, United Steel Cos., Sheffield, set a record by producing 2,042,056 tons of ingots. This is not only 146,000 tons better than it did in any previous 12 months but is a record for any British operator.

Dorman, Long & Co., British steel producers, announced last week that it would spend £8 million ($32,000,000) on a new openhearth shop with a rated capacity of 500,000 tons annually. It is scheduled for completion by September 1952. The company already has an expansion program under way to cost the equivalent of $10 million.

French Hope to Cut Ore Cost

Paris—Studies looking toward reducing the cost of French Moroccan manganese ore may be completed this year. Truck freight is the major item in its cost. Last year trucks hauled about 130,000 metric tons of ore from Tiouine and Imini in the Atlas Mountains in the south to the inland port of Marrakech. These trucks covered a total of about 2.8 million miles in 1948, accounting for approximately 75 pct—or $105 per metric ton—of the cost of the ore f.o.b. Marrakech.

To lower these costs, preliminary studies of the possibility or building a railroad or a conveyor are being made in the area. The survey will probably be completed this year and will determine whether Moroccan manganese can be priced competitively in the

Turn to page 162

IRON AGE
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FEATURE ARTICLES

Miscellaneous small parts formed of low carbon steel and then homogeneously carburized to various carbon levels to develop required properties.

HOMOGENEOUS CARBURIZING

Summary: Homogeneous carburizing is a through-carburizing technique that makes possible the fabrication of medium and high carbon steel parts from low carbon steel stock. A description of the process is presented, including a discussion of existing and potential practical applications.

By ORVILLE E. CULLEN
Chief Metallurgist,
Surface Combustion Corp.,
Toledo

FROM the standpoint of the steel manufacturer, carbon content is of immediate concern only in that it must meet the specifications of the purchaser of the steel. These specifications may provide for low carbon steel for ease in spinning, piercing, pressing, stamping or machining, or, on the other hand, they may provide for medium or high carbon where hardness and strength are necessary.

To the purchaser of steel, the choice of optimum carbon content is not always a simple matter. True, there are a number of applications which permit taking full advantage of the required amount of carbon in the steel without suffering unduly from the disadvantages and difficulties which the particular carbon content introduces into the processing of the metal. For example, low carbon steels are excellent for shearing, deep drawing, extruding or stamping where extra hardness and strength are not end-product requirements. Also, such steels are extremely useful where extensive machining is involved, but through hardening and high mechanical property values are not considered necessary in the final application.

In many cases, processing requirements dictate the use of low carbon steel, but service conditions indicate the need for high surface

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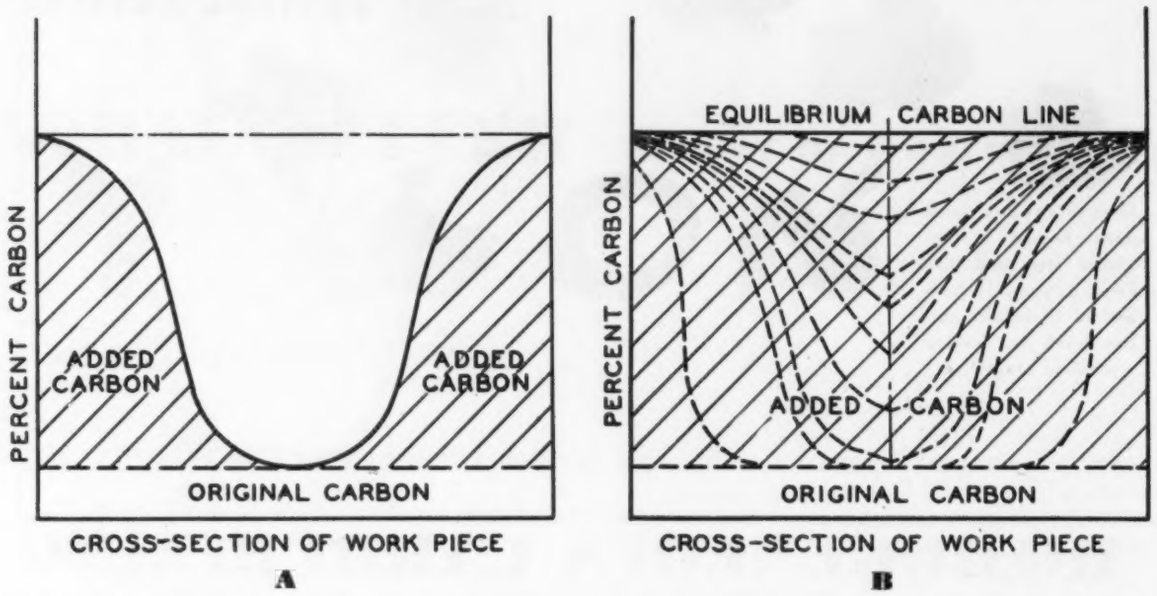


FIG. 1—Carbon distribution across low carbon steel piece, subjected to conventional carburizing process, is illustrated at *A*, while *B* shows carbon distribution across low carbon steel piece subjected to homogeneous carburizing process. Broken lines indicate successive increments in the development of the uniform carbon content through the section.

hardness as well as some added strength over and above the limits of the steel in question. Carburizing or nitriding can provide these desired service characteristics. Surface hardening increases overall strength and wear resistance, the former to a degree depending upon the depth of carbon or nitrogen penetration.

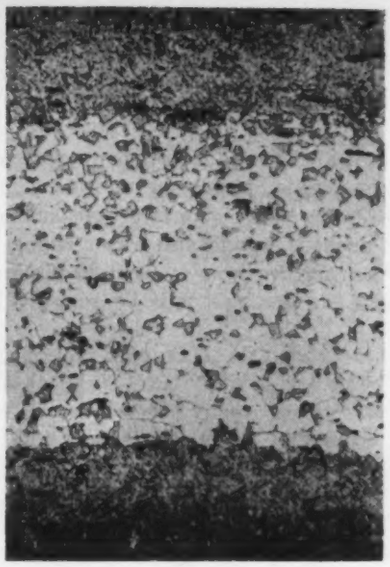
In other cases, mechanical properties attributed to high carbon must exist throughout the entire cross-section of the steel. Therefore, the optimum carbon content must be present throughout and a suitable steel is specified. If severe cold forming is included in the processing, spheroidized stock must be purchased and frequent subcritical anneals must be relied upon to maintain a workable steel. Additional possible precautions for sheet stock include holding the chemistry within narrow limits and specifying cross-rolling to minimize tendencies toward cracking during forming. Also, control of decarburization during annealing is necessary, otherwise final grinding to size will be mandatory. The heat treat and cost departments particularly appreciate the problems involved in production of parts under such conditions.

In the past many serious attempts have been made to take advantage of the possibilities of using a low carbon steel for fabrication of complex parts, and, thereafter applying a carbon impregnation treatment to build up the carbon content of the steel throughout its entire thickness. Such attempts were generally unsuccessful due to lack of uniformity of carbon throughout the work and to difficulties in controlling carbon content particularly when values in the range of 0.35 to about 0.70 pct C were required. Consequently, while the idea was recognized as a useful one, it was not found to be practical in application.

Recently, another approach to the problem has met with remarkable success. Modern developments in gas carburizing and greatly improved understanding of reactions involved in carbon control during gas carburizing have paved the way for a process known as *homogeneous carburizing*.

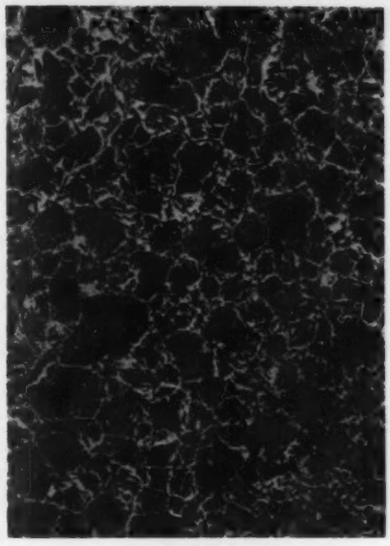
High Carbon Potential Required

Homogeneous carburizing, which permits transformation of a low carbon steel into a medium or a high carbon steel after fabrication, and oftentimes during the final step of heating for hardening, is not a normal carburizing treatment in the usual sense of the word. During gas carburizing the atmosphere surrounding the work is maintained at a high carbon potential, i.e., a high concentration of carburizing constituents is available in the atmosphere, and a high carbon concentration is built up in the surface of the steel. This highly carburized zone tapers off beneath the surface until it merges into the low carbon core of the steel. In homogeneous carburizing, the carbon content is built up to the same value throughout the entire thickness of the steel. These basic differences are shown in figs. 1 and 2.



A

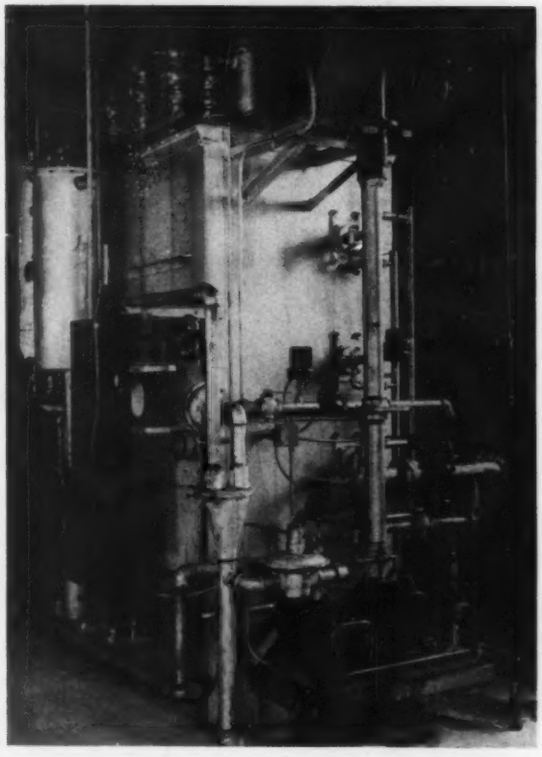
FIG. 2 — Photomicrographs illustrating (A) conventional carburizing process, and (B) homogeneous carburizing process. 100X.



B

BELOW

FIG. 3—Typical atmosphere generator with capacity of 3600 cu ft per hr.



From the above figures, it can be seen that both normal carburizing and homogeneous carburizing are based on the ability of an atmosphere to supply carbon to steel within the range of heat treating temperatures. Carbon thus supplied to the surface of the metal moves inwardly by diffusion, hence the rates of penetration are established by well-known physical laws. The rate of carbon diffusion into iron (austenitic) at constant temperature varies directly as the square root of the time t, thus: *Case depth* $= K\sqrt{t}$, where K is a constant for the type of steel and temperature employed. By inspection of carbon gradients it will be observed that rate of diffusion decreases as the slope of the gradient decreases or as the case depth increases.

When the slope of the carbon gradient is quite steep, as it usually is in normal carburizing, diffusion of carbon from the outer surface of the steel to the inside is rapid enough to prevent excessive concentration of carbon in the outer layers of the metal. Carburizing is therefore usually carried on with the surrounding furnace atmosphere higher in carbon potential than the actual maximum carbon concentration desired in the case. For very deeply carburized cases surface carbon concentration will build up to a value approaching and nearly equalling the carbon potential of the furnace atmosphere.

Adds Carbon Throughout Section

For homogeneous carburizing the carbon potential of the atmosphere is adjusted equal to the carbon desired in the steel. When low carbon steel is heated in this atmosphere, carbon content gradually rises until an equilibrium is established between the atmosphere and the work. Once this equilibrium has been attained throughout the entire cross-section of the work there is no further exchange of carbon between atmosphere and steel regardless of the length of time of treatment.

From the above it will be appreciated that the homogeneous carburizing process is an extension of normal gas carburizing to produce a steel of uniformly increased carbon content. The principles of atmosphere balance, which have been applied to gas carburizing to permit control of surface carbon concentration, regardless of case depths, have been just as satisfactorily adapted to homogeneous or

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through carburizing at any desired carbon level from 0.10 to 1.00 pct C, or higher, if required.

Atmospheric Requirements

There are several ways in which prepared atmospheres may be employed to provide varying degrees of carbon control for treating steel. Success of such methods usually depends upon a number of factors that are not always readily applicable to the treatment of various steels with different carbon requirements or of a particular steel part with variable cross-sections.

For universal use, practical carbon concentration control is preferably based on the fact that for any desired carbon content, at the temperature of heat treatment, there is an atmosphere in balance with the carbon content desired in the steel. The requisites for such an atmosphere are ease of production, simplicity of control and reasonably low cost.

Such an atmosphere is provided by a Surface Combustion RX generator, see fig. 3, which is an endothermic type gas generator that catalytically reforms mixtures of hydrocarbon fuel gases and air to produce atmospheres rich in carbon monoxide, hydrogen and nitrogen. The atmospheres may contain measurable amounts of carbon dioxide and water vapor, if desired. When natural gas is used to produce reformed gas the analysis will be roughly 20

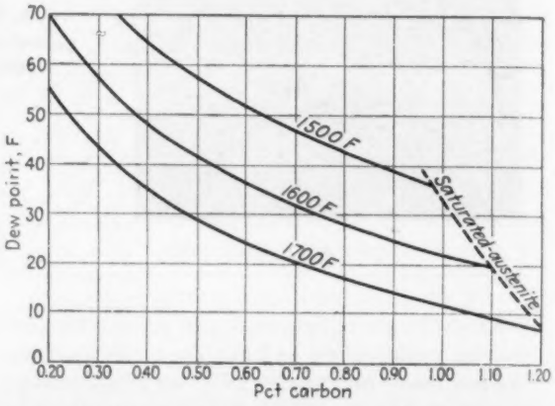


FIG. 5—Relationship between dew point and carbon content of steels at various temperatures, for an atmosphere containing 20 pct CO and 40 pct H_2.

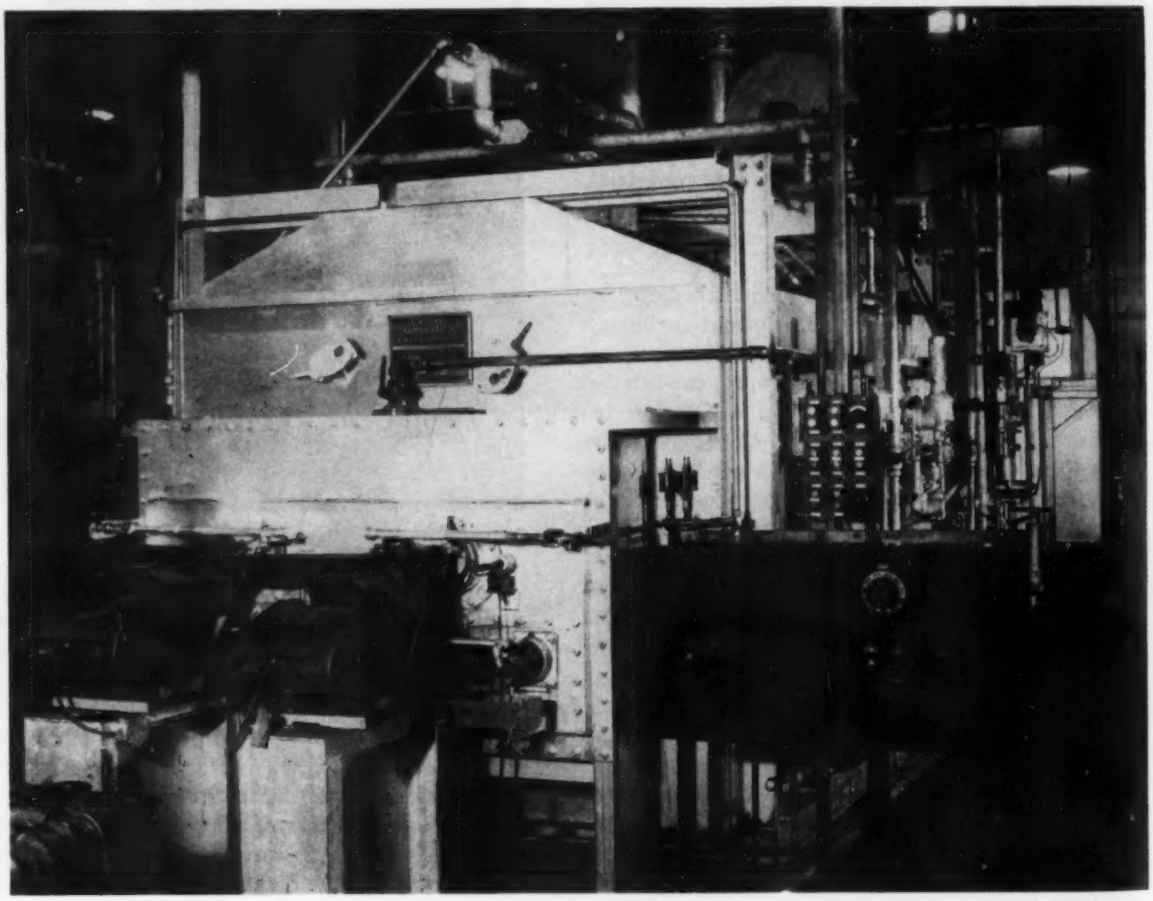
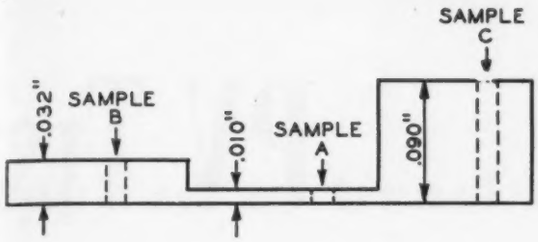


FIG. 4—Rotary retort continuous carburizing furnace used for small automotive parts. This furnace represents a recent development by Surface Combustion Corp. and is readily adaptable to homogeneous carburizing.



pct carbon monoxide, 40 pct hydrogen and 40 pct nitrogen, plus desired amounts of carbon dioxide and water vapor.

Wide use of this type of generator in the gas carburizing, dry cyaniding, carbon restoration and clean hardening fields should make it unnecessary to describe its operation at this time. The catalytic cracking unit used for homogeneous carburizing should be adapted by design and construction to maintaining an output of atmosphere gas of constant analysis with a minimum of adjustment and other maintenance problems. Careful selection of the generator eliminates one of the more prominent sources of trouble in homogeneous carburizing.

The homogeneous carburizing process is adaptable for use with either batch type or continuous furnaces, see fig. 4. The chief requirement is that the steel be heated in a chamber suitable for complete exclusion of both air and flue gas. Modern gas carburizing, dry cyaniding and clean hardening furnaces are suitable, provided they are designed and constructed with the necessary safeguards for good atmosphere control.

Dew Point v. Carbon Content

As emphasized above, homogeneous carburizing is essentially the result of establishing equilibrium conditions with regard to desired carbon content of steel and the carburizing potential of the surrounding atmosphere. Also it was pointed out that a most suitable type of furnace atmosphere was one containing appreciable amounts of carbon monoxide and hydrogen with these gases preferably in the neighborhood of 20 pct CO and 40 pct H_2. For a more comprehensive discussion of the theoretical considerations involved in homogeneous carburizing as well as the advantages for using the type of atmosphere described, reference is made to a paper by deCoriolis, Cullen and Huebler.[1] In that paper, it was proved that such RX type atmospheres permit accurate control of equilibrium carbon conditions by dew point determination.

Fig. 5 shows the relationship between the dew point of a furnace atmosphere and the carbon content of steel at temperatures of 1500°, 1600° and 1700°F. To illustrate the use of these curves, suppose it is desired to homogeneously carburize a low carbon steel to 0.50 pct C at a temperature of 1700°F. From the figure, the dew point of the furnace atmosphere should be 29°F. Actual practice has proved that if a relatively thin piece of steel is placed in a furnace heated to 1700°F, and the furnace atmosphere comprises an endothermic type generator gas containing approximately 20 pct CO, 40 pct H_2, 40 pct N_2 balanced to a 29°F dew point, the steel will be carburized throughout to 0.50 pct C. Once this balanced condition of 0.50 pct C in the steel is attained, it will not change to a higher or a lower value regardless of the time of heating providing the above-mentioned furnace atmosphere conditions are maintained.

It is, of course, necessary to hold the steel at temperature long enough for carbon to dif-

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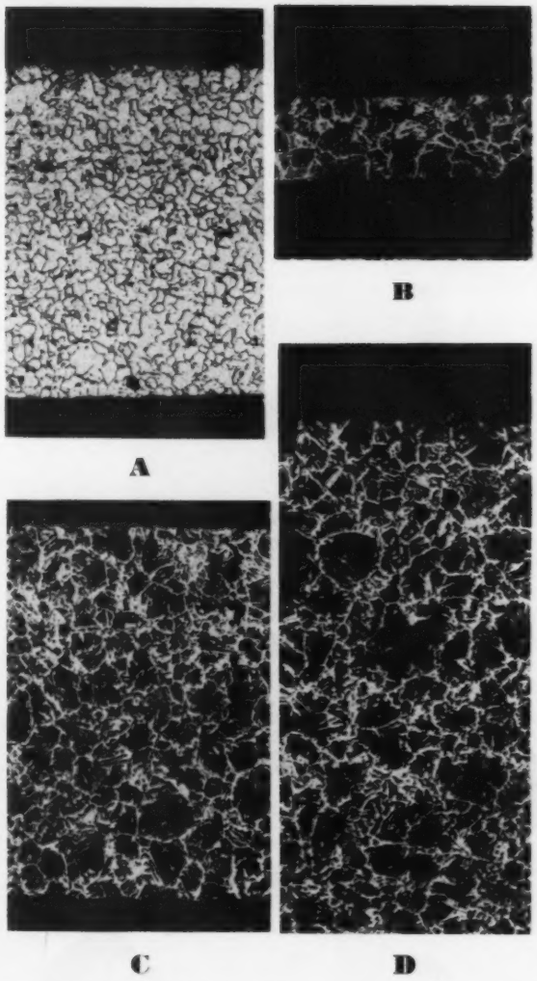

FIG. 6—Samples taken from three areas of different section thickness in a homogeneously carburized SAE 1010 steel piece. Photomicrograph (A) represents the original steel, before carburizing, 0.032 in. thick; while photos (B), (C) and (D) represent through-carburized specimens, 0.010, 0.032 and 0.090 in. thick respectively. (D) shows a section from outside edge to centerline of thickness. 100X.

[1] *E. G. deCoriolis, O. E. Cullen and J. Huebler, "Carbon Concentration Control," Trans. ASM, 1947, vol. 38, p. 659.*

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PV TEST A

FIG. 1—PV testing procedure for determining hardenability of shallow hardening steels: (A) Machined PV test specimen; (B) specimen heated at 1500°F for 1 hr; (C) specimen water quenched on special fixture; (D) section cut from specimen for hardness test; (E) section surface ground; (F) Rc measurements made on section; (G) typical PV hardness curve.

EVERY gear manufacturer is confronted by the problem of what steel to use and of what hardenability. Medium carbon forging quality steel has much to commend it for gearing use as it can be heat treated to a high surface hardness and still retain a tough, ductile core. The hardenability variation among different heats is appreciable, however, and the results obtained by heat treating vary accordingly.

Assuming that such steel has the proper hardenability, some advantages to be gained from its use are as follows:

(1) Good wearing qualities because of the high surface hardness. The movement of the teeth in a pair of gears with respect to each other is a combination sliding and rolling action; therefore, a hard surface is desirable.

(2) Heavy load carrying capacity. Although no wear takes place at the root of the tooth, the load transmitted by the gear teeth is concentrated at the root similar to the loading of a cantilever beam. The high root hardness achievable with medium carbon steel can withstand these high bending stresses.

(3) Ability to withstand shock loading without shattering. The tough ductile core of the teeth imparts high resistance to impact loading.

(4) Properly treated medium carbon steel develops high surface compressive stresses. Because of the shallow hardening characteristics of this steel, favorable compressive stresses are developed on the surface that increase its load-carrying capacity.

Hardenability Influences Core Toughness

If the hardenability of a steel is too low, the hard surface cannot be achieved, and the favorable compressive stresses are not present. On the other hand, if the hardenability is too high, the teeth harden too deeply and both core toughness and compressive stresses of the surface are reduced. It is because of the loss in core toughness and of the favorable compressive stresses

Applied to Gearing Steel

Summary: The PV test is a simple, inexpensive production line method for determining the hardenability of shallow hardening steels. A description of the testing procedure employed on gearing steels, particularly as applied to medium carbon steels, is given in this article.

By J. G. CHRIST
Gearing Div.,
Westinghouse Electric Corp.
Pittsburgh

that alloy steels are at times not as desirable as medium carbon steel.

Hardenability control is essential in the use of medium carbon steel to assure optimum properties of a heat-treated steel in the finished gearing product. The first step, taken many years ago, was the use of a restricted chemistry. It was found that the extent of restriction depended upon mill practice and upon the price of the resulting steel. It was not practical, especially during times of steel scarcity, to have too restricted a chemistry, for not only was steel more difficult to obtain, but the problem of off-heats was present. The only general rule developed by this early work was that carbon content plus manganese content should not be less than 0.95 pct nor more than 1.15 pct.

Former Tests Inadequate

A number of hardenability tests have been developed among which the Jominy test[1] was outstanding, because of the relatively simple laboratory technique required in carrying out the test. It was found, however, that the standard Jominy test was not of sufficient sensitivity to pick up differences in hardenability in medium carbon steel. Shortly afterwards, the "L" bar test[2] was developed for shallow hardening and carburizing steels. This test was of sufficient sensitivity but was more expensive to perform and the L sample often cracked during the drastic quench.

Grossman's calculated hardenability work[3] has also been an aid in determining the hardenability of medium carbon steel, because of the increase of residual alloys in the plain carbon steel heats.

Recently, the PV hardenability test[4, 5] for shallow hardening tool steels was developed by Shepherd. A sketch of a PV sample and the general nature of the test is outlined in fig. 1. The sample is roughly 1½ in. in diam and about 1⅛ in. long with a 90° wedge-shaped end. After being heated above the critical temperature, the sample is quickly placed on the special quenching fixture, which is so designed that it cools the hot sample as rapidly as the heat is transmitted to the two surfaces. Since the cooling rate is the same for each sample, the relative hardenability of the various heats can be determined. A slice is then cut from the center of the sample, is surface ground and hardness readings are taken at measured distances from the tip of the slice.

In cooperation with Shepherd, some trial PV tests were made on a number of medium carbon steel heats. Table I shows the heats chosen for the trial tests, and fig. 2 shows the PV curves obtained. These PV samples were normalized for 1 hr at 1600°F, heated 1 hr 20 min at 1500°F, and quenched in the PV fixture with a 10 pct brine solution. The high hardenability of heats

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PV Test Applied to Gearing Steel

Continued

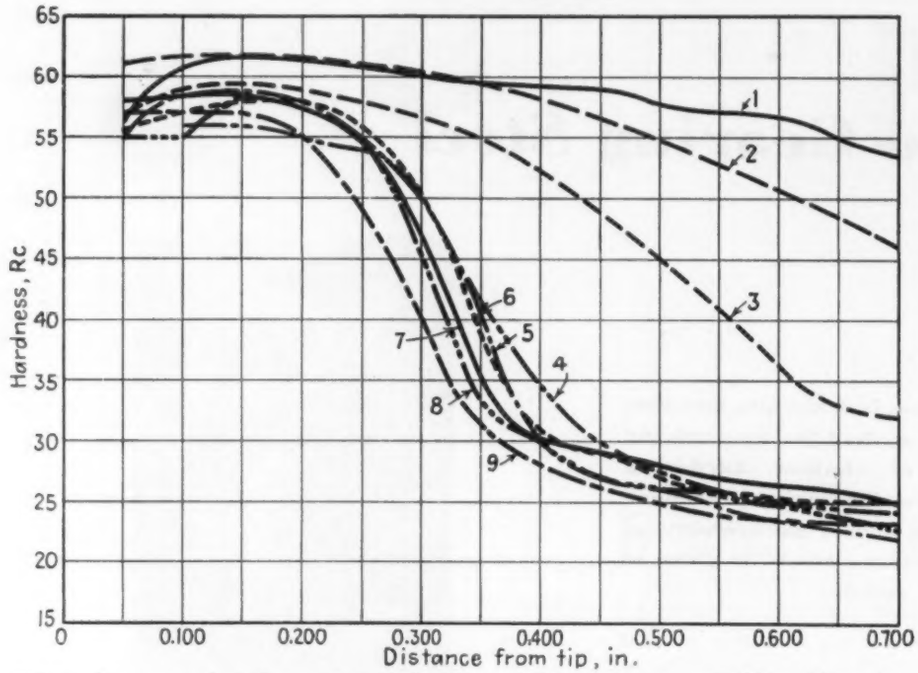

FIG. 2—PV curves of medium carbon steels. Curve numbers refer to compositions (shown in table I) of the various samples tested.

nos. 1, 2 and 3 is brought out clearly by the curves. The other heats are all within a narrow range. On the basis of this preliminary work, the PV test equipment was obtained, numerous PV tests were run, and the test is now standard procedure on all heats of SAE 1045 forging quality steel.

For medium carbon steel, 45 Rc has been found by investigators to be the hardness of 50 pct martensitic structure. The distance of this hardness from the tip of the PV slab is taken as the PV hardness number of the particular heat. The PV sample is not normalized but given a treatment of 1500°F for 1 hr, thus more closely simulating the treatment given the gearing product.

Correlation between the PV tests and the heat treating results has been good. It has been found that heats with PV numbers over 0.500 are likely to crack during the quenching operation and if not cracked, are prone to be hardened throughout the tooth. Heats with PV hardenability numbers of less than 0.250 do not always harden properly depending upon the tooth and section size of the particular item. The steel need not be brought to a hardenability specification as it can be channeled for uses other than gearing if its PV number is on either side of the preferred range. The limits of PV 0.250 to 0.500 are tentative and subject to change in the light of future data.

Correlation between PV and calculated ideal diameter hardenability is only fair for the medium carbon steels. The hardenability of medium carbon steel is strongly effected by small quantities of residual alloys. The small amount of these alloys is difficult to determine and is subject to some error. This error is carried over into the calculated hardenability results. The accuracy of the calculated D_1 is given as within 20 pct by an AISI publication.[6] With these variables in mind, the lack of better coorelation between PV and calculated hardenability is understandable.

This article has outlined the use of the PV test for determining the hardenability of medium carbon forging grade steel and the correlation of this hardenability to the heat treatment of medium carbon steel gearing. It is not to be implied that this work has solved all heat treating problems or that the full usefulness of the PV test has been achieved or that the PV test is the ideal test for the steel concerned. It has, however, been of sufficient value that the author recommends its use be extended and possibly standardized for shallow hardening steels.

TABLE I

Chemical Analysis of PV Tested SAE 1045 Steel

	C	Mn	P	S	Si	Ni	Cr	Mo	Va	Grain Size
1.	0.47	0.89	0.018	0.030	0.24	0.35	0.23	0.09	.....	5, 6
2.	0.47	0.71	0.021	0.038	0.23	0.21	0.26	0.03	.....	6
3.	0.44	0.80	0.018	0.027	0.22	0.28	0.19	0.05	.....	7
4.	0.44	0.58	0.026	0.031	0.23	0.06	0.04	.....	0.07	5, 4
5.	0.47	0.76	0.011	0.027	0.23	.....	.....	.....	.....	5, 6
6.	0.44	0.78	0.025	0.035	0.24	.....	.....	.....	.....	5, 6
7.	0.40	0.71	0.012	0.033	0.22	.....	.....	.....	.....	5, 6
8.	0.43	0.73	0.015	0.038	0.08	.....	.....	.....	.....	6, 7
9.	0.44	0.45	0.019	0.028	0.21	.....	.....	.....	.....	6, 7, 8

References

[1] W. E. Jominy and A. L. Boegehold, "Hardenability Tests for Steels," Trans. ASM, 1938, p. 574.

[2] W. E. Jominy, "Hardenability Test for Shallow Hardening Steels," Trans. ASM, 1939, p. 1072.

[3] M. A. Grossman, "Hardenability Calculated from Chemical Composition," Trans. AIME, Iron & Steel Div., 1942.

[4] B. F. Shepherd, "The Hardenability of Shallow Hardening Steel Determined by the PV Test," Trans. ASM, 1947, vol. 38, p. 354.

[5] E. S. Kopecki, "The PV Test," The Iron Age, Nov. 14, 1946, p. 66.

[6] "Contributions to the Metallurgy of Steel,"—No. 12, AISI, February 1946.

[7] "Hardenability of Alloy Steels," ASM Symposium, Oct. 17 to 21, 1938.

Arthur W. Logozzo, Nutmeg Chrome Corp., Hartford, new president of the AES (left). William J. Neill, Columbus Metal Products Co., Columbus, Ohio, elected first vice-president of AES (right).

AES *Studies Methods of*

PLATING AND FINISHING

Summary: Electrodeposition of nickel at high current density, plating on aluminum, amorpheus phosphate coatings for aluminum, plating magnesium, PR cyanide copper plating and plating on carbon steel are among the subjects covered in this article as abstracts of papers presented at the recent annual meeting of the American Electroplater's Society.

THE 36th annual convention of the American Electroplater's Society, held recently in Milwaukee, was highlighted by a technical program embracing a wide variety of top-notch papers on plating and finishing subjects. The meeting, with an attendance in excess of 1000, was arranged by the Milwaukee branch of the society under the general chairmanship of William C. Geissman, National Lock Co., Rockford, Ill.

One of the features of the meeting was the presentation of the annual awards for outstanding papers of the past year. The Founders' Gold Medal for the best paper read at the 1949 convention was awarded to W. A. Wesley, assistant director, and W. W. Sellers, research chemist, both of International Nickel Co., Inc., New York, and E. J. Roehl, Thomas Steel Co., Warren, Ohio, for their paper entitled "Electrodeposition of Nickel at High Current Density." The $50.00 award for the best paper published in *Plating* during the past year went to L. B. Sperry and M. R. Sperry, for the paper "Destruction of Cyanide Copper Solutions by Hot Electrolysis."

The AES Gold Medal for the best paper published in *Plating* by a member of the society in the past year was awarded to J. S. MacDaniel

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and C. F. Nixon for the paper "Design for Plating." A. P. Schulze received the Mechanical Finishing Award, sponsored by Lea Mfg. Co., for his paper entitled "Mechanical Finishing With Roto-Finishing Techniques," and R. Seegmiller and B. A. Lamb were awarded the Chromium Plating Award, sponsored by Nutmeg Chrome Corp., for their paper, "Oxidation of Trivalent Chromium in Chromic Acid Plating Solutions."

The society plans to hold the 1950 convention in Boston; the 1951 convention will be held in Los Angeles; and 1952, in Chicago.

Plating on Aluminum

Plating Procedures Evaluated . . . hot acid etch removes oxide film

THE various factors which affect the preparation and plating of aluminum alloys were discussed in a paper entitled "Plating on Aluminum Alloys" by Fred Keller and Walter G. Zelley, Aluminum Research Laboratories, New Kensington, Pa. The effects of different cleaning and conditioning treatments were correlated by surface resistance measurements, and the influence of composition and microstructure on the character of the zinc deposit was described as well as a test for evaluating plating procedures.

The cleaning and conditioning treatments required for aluminum alloys have a three-fold purpose: (1) To remove oil, grease, dirt and other contamination so that the surface will respond to etching treatments; (2) to remove the natural oxide film and replace it with a thinner and more uniform and suitable film and (3) to remove certain microconstituents, which may subsequently react during the plating operation.

In cleaning, when much oil or grease is present, either vapor degreasing or solvent cleaning may be necessary. Ordinarily a mild alkaline cleaner can be used. Such a cleaner should be of the type suitable for use with aluminum. A suitable cleaner of this general type can be made by using 3 per cent each of sodium carbonate and sodium phosphate. This solution is generally used at a temperature of 140° to 180°F for 1 to 3 min.

A more effective treatment for removal of the natural oxide film and undesirable constituents employs a hot acid etch containing 25 per cent H_2SO_4 (by weight) for about 5 min. at 180°F. This treatment produces uniformly good results on all wrought aluminum alloys, especially when it is followed by a dip in 1:1 nitric acid.

Another effective conditioning treatment involves a double dip in the zinc-immersion solution, the first zinc deposit being removed by nitric acid.

Since aluminum is less noble than most of the common metals, it will replace many of these metals from solutions of their salts. This property forms the basis for the zinc-immersion procedure. The chief function of this procedure is to remove the very thin oxide film from the surfaces of the parts that are to be plated and to replace it with a thin layer of metallic zinc. This provides a surface which will be receptive to electrodeposits of other metals. For this immersion treatment a strongly alkaline solution of the following composition is used at room temperature (60° to 80°F.): 5 g caustic soda (commercial 76 pct), 100 g zinc oxide, and 1 liter of water to make.

When a properly conditioned aluminum alloy part is immersed in this sodium zincate solution, the thin and uniform oxide film that is present dissolves, and as soon as underlying aluminum is exposed it also starts to dissolve and is immediately replaced by an equivalent weight of zinc. When the aluminum surface is completely covered with an extremly thin layer of metallic zinc, action in this solution virtually ceases. Most of the reaction appears to take place during the first few seconds of the immersion period which is usually from ½ to 2 min. duration.

A copper strike is usually applied over the zinc immersion layer before other metals are deposited. Silver, brass, zinc, nickel or chromium may be deposited directly on the zinc layer, provided that the plating procedures employed are suitable for plating on zinc and do not penetrate the zinc layer and cause attack on the aluminum base. Very good results are being

TABLE I

Rochelle Copper Strike

	g per liter	oz per gal
Copper cyanide	41.25	5.5
Total sodium cyanide	48.75	6.5
Sodium carbonate	30.00	4.0
Rochelle salts	60.00	8.0
Free cyanide (max)	3.75	0.5

Continued

obtained with a plating system which comprises a copper strike such as that in Table 1, a relatively thick (1 to 2 mil) nickel plate and a final chromium plate about 0.01 to 0.02 mil in thickness.

With most plating systems used for aluminum alloys, any exposed aluminum will function as anode and the plating as cathode under conditions where an electrolyte is present, and galvanic action will occur with the aluminum as a sacrificial metal. The amount and extent of galvanic attack, however, will be dependent not only on the potential difference but also on the amount of current that flows.

This is probably the most important factor in rate of attack and is influenced by a number of variables, such as changes in resistance in the circuit as a result of polarization and other effects. One of the more important characteristics of chromium plating when it is applied over nickel plating on aluminum alloys is its ability to reduce the amount of current flowing from any exposed aluminum areas on the plated articles.

Phosphate Coatings for Aluminum

Rapidly applied . . . economical . . . Improve paint anchorage

THE protection afforded by organic protective and decorative films such as paint, which assist in the protection of aluminum against corrosion, is generally limited by two factors: (1) corrosion beneath the paint film and (2) the lack of adhesion of the paint film to the metal, according to Alfred Douty and F. P. Spruance, Jr., American Chemical Paint Co., Ambler, Pa. in their paper "Amorphous Phosphate Coatings for Protection of Aluminum Alloys and Paint Adhesion."

Only one variety of chemical oxide coating process has reached great importance in the corrosion protection field in this country. That process consists in treating the work in hot (about 150°F.) 2 to 3 pct sodium carbonate containing 0.1 pct potassium or sodium dichromate for 10 to 20 min. or more. Subsequently a sealing treatment in hot (180° to 190°F.) 5 pct potassium or sodium dichromate for 10 min. is required. The coating is softer, more porous and not quite so effective as that produced by chromic acid anodizing.

A recent development has been the chemical production of crystalline phosphate coatings on the surface of aluminum. In one method, coatings consisting essentially of zinc and aluminum phosphates are caused to form on the surfaces by treating them with zinc phosphate solutions containing fluoboric acid. Such coatings, as phosphate coatings on steel or zinc, are crystalline, with interstices between the crystals. Unless protected by organic coatings, they offer less protection to the metal than do the oxide films. However, they are rapidly and economically applied and afford a good initial paint anchorage, although they offer less resistance to under-film corrosion than do chemically or electrically produced oxide coatings.

Early in 1945 a new chemical process, the Alodine[1] process, was introduced for furnishing aluminum with an amorphous phosphate coating. The simplicity, speed, and economy of the process and the unique properties of the coating have resulted in wide commercial acceptance. This coating is essentially an amorphous metallic phosphate coating. It is dense, quite hard, and apparently non-porous. Unlike most oxide films it is unabsorptive and cannot be dyed or stained. Sealing in hot water or salts is without apparent effect. It differs markedly in appearance from previously known phosphate coatings.

[1] *See "New Surface Treatment for Aluminum,"* THE IRON AGE, *Dec.* 5, 1946.

Electroplating Magnesium

Mg surface must be free nonmetallic contamination

A NEW process that has been developed and thoroughly investigated through laboratory tests and pilot plant operations for electroplating on magnesium was reported on by H. K. DeLong, Dow Chemical Co., Midland, Mich. in a paper "Electroplating Magnesium and its Alloys". With this process any of the metals that are capable of being electrodeposited can be applied to magnesium in a very adherent manner. In general, the process consists in the initial application of an immersion zinc coating followed by copper striking and electroplating in standard plating baths.

The most suitable solution for applying the zinc immersion coating to standard magnesium alloys by this method has the composition and operating characteristics shown in Table II.

Unalloyed or pure magnesium requires a lower fluoride concentration. In this case, 2.5 to 5 g per liter potassium fluoride has been found most suitable.

The surface must be free of non-metallic contamination such as the normal oxide or hydroxide coatings, inclusions of oxide, mill-scale, dirt, forming lubricants, previously applied chemical treatment coatings, oil, and grease. To insure the removal of foreign materials of these varied natures the parts are first degreased

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and pickled prior to mechanical operations such as buffing. The pickling also tends to remove intermetallic compounds and precipitates which primarily occur in castings. It is particularly important to pickle parts that are not buffed, or are not buffed overall, so as to prepare the unbuffed surface for zinc coating. To obtain a satisfactory surface condition cast parts are pickled in 75 to 85 pct phosphoric acid, while wrought parts are pickled in 20 pct acetic acid plus 5 pct sodium nitrate. The pickling is carried out at 70° to 90°F. and pickling times of 1 to 3 min. are required.

After the pickling operations, if a smooth highly polished surface is desirable, the parts are wheel polished and buffed. In case of small parts, tumbling and burnishing operations may be used. Where blasting operations are used, such operations should precede the preliminary pickling. Blasting leaves a surface that is highly reactive and not suitable for plating, unless pickled afterwards.

After the parts have been prepared, the following steps are required in electroplating: (A) Solvent degrease by any of the common methods such as vapor degreasing, and solvent emulsion cleaning, if buffing compound, heavy oil, or grease films are on the surface. (B) Soak clean for 3 to 5 min. at 180° to 212°F in an aqueous alkaline cleaning solution containing 8 to 12 oz sodium hydroxide per gal, and 4 oz per gal trisodium phosphate ($Na_3PO_4:12H_2O$). Cathodic cleaning for 30 sec to 1 min. in this solution at 20 to 40 amps per sq. ft. at the end of the soak cleaning period is optional, but preferable. A wetting agent or soap may be added to this cleaning solution to improve its detergency. (C) Pickle for 15 sec to 1½ min. in 1 pct HCl. This pickle tends to activate the surface after alkaline cleaning. It should be for sufficient time to insure a uniform etching of the surface, so that local passive areas are broken down and do not interfere with obtaining a uniform zinc coating. The addition of 0.05 to 0.1 pct sodium sulphate to this pickling solution tends to inhibit preferential etching at the grain boundaries and results in a smoother surface after pickling. (D) Apply the zinc immersion coating as previously described. (E) Copper strike the zinc coated parts immediately after cold water rinsing in one of the two copper cyanide baths shown in Table III.

Copper can be plated in heavier deposits by prolonging the time in the initial baths, or by transferring the work to other alkaline copper cyanide or pyrophosphate baths.

TABLE II

Zinc Immersion Solution for Magnesium Alloys

Tetrasodium pyrophosphate	120 g per liter
Zinc sulfate	40 g per liter
Potassium fluoride	7 g per liter
Potassium carbonate	5 g per liter
Treatment time	3 to 5 hr
Operating temperature	175° to 185° F.
pH	10.0 to 10.4

Solution mildly agitated.

TABLE III

Copper Strike Baths for Magnesium Alloys

BATH No. 1	g per liter	oz per gal
Copper cyanide	41.3	5.5
Sodium cyanide	50.8	6.8
Sodium carbonate	30.0	4.0
Rochelle salts	45.0	6.0
Free cyanide	5.6	0.75

pH..... 10.0 to 11.0 (preferably adjusted to 10.0 to 10.5)
Temperature..... 115° to 120° F.

BATH No. 2	g per liter	oz per gal
Copper cyanide	26.25	3.5
Potassium cyanide	45.75	6.1
Potassium carbonate	15.00	2.0
Potassium hydroxide	7.50	1.0
Potassium flouride	30.00	4.0
Free cyanide	7.50	1.0

pH..... 12.8 to 13.2 (not as critical as in Bath A)
Temperature..... 130° to 150°F (140°F preferred)

Cu Plate Prevents Mg Attack

Nickel may be applied from any of the conventional baths after plating. It is preferable that the nickel bath have a pH of about 4.0 or above, but good results have been obtained in lower pH baths. A copper plate of about 0.0005 in. min. thickness must first be applied to prevent attack of the magnesium through the pores in the copper. As much as 0.0008 in. may be required on deeply recessed parts to insure that no chemical pitting will occur in low pH high nickel salt concentration plating baths.

Cadmium and zinc have been applied directly over the zinc immersion coating from standard cyanide baths. Application over the initial copper strike has produced better results than application directly over the zinc immersion coating, particularly in the application of cadmium. In plating cadmium and zinc direct, electrical contact must be made before introducing the work into the solution or immediately thereafter.

Brass may be applied either directly to the zinc immersion deposit from a standard cyanide type bath, or after the initial copper strike.

Silver may be applied from conventional cyanide baths after the initial copper strike, but it is preferable to plate heavier copper, and apply a nickel strike, before silver plating to obtain the best adhesion between the copper and silver.

Chromium has been applied directly to the zinc immersion coating in standard baths. Electrical contact must be made before introducing the work into the solution and an initial current

density of about 300 amps per sq. ft. applied for 10 to 30 sec after which the current density may be reduced to normal. Direct chromium plating is limited to simple shaped articles. Copper-nickel-chromium deposits may readily be applied, or chromium may be applied after copper striking for certain applications.

Recent pilot plant tests have proven that small magnesium parts can be readily batch processed by barrel plating methods such as used on other metals. Copper, copper-nickel, and black nickel deposits have been applied in a conventional plating barrel. Bright barrel plated nickel, followed by rack chromium plating, is possible without the necessity for buffing the nickel before chromium plating.

In stripping deposits from magnesium, care must be taken to avoid severe etching of the surface.

Copper-nickel-chromium deposits have withstood 48 to 168 hr in salt spray without failure, the time of exposure before initial failure depending on the thickness of the nickel deposit. Nickel deposits in these tests ranged from 0.0005 to 0.0015 in. in thickness.

Silver and chromium plated test panels have withstood 90 days in high humidity at 95°F and 85 to 95 pct relative humidity. Little indication of blistering or corroded areas have been noted.

No failure has occured in chromium plated parts in rural exterior exposure tests after six months. In this test the thickness of the nickel was varied also from 0.0005 to 0.0015 in. and the test is still in progress at this time.

PR Cyanide Copper Plating

First organic high speed cyanide . . . 7 microinch finish produced

WHEN PR plating was introduced it was evident that a new tool had been made available for the electroplating industry. However, many variables had to be explored before the process could be commercially applied to secure optimum results. George W. Jernstedt, Manager of Electroplating Projects, Westinghouse Electric Corp., East Pittsburgh, Pa., described conditions, including cycles, solution compositions and addition agents in a paper entitled "PR Cyanide Copper Plating," which included a description of the first inorganic high-speed cyanide solution.

Examples of the smoothening possible with this process were cited. A surface of 35 microinches was reduced to 7 microinches through the use of the process. A method of obtaining various physical properties, especially hardnesses from 100 to 200 Vickers with excellent ductility, was explained.

An inorganic addition agent[2] was mentioned in this paper which is now in use commercially. This material eliminates the control problem with the organic compounds and is lower in cost.

[2] *A metallic, inorganic, addition agent, patents applied for by the Westinghouse Electric Corp.*

A cyanide copper plating process employing this addition agent, PR current, and solution composition as recommended is easy to operate in production.

Heavy, smooth deposits are readily obtainable with the organic free PR cyanide copper process. Record stampers 0.040 in. thick with a mirror-bright surface may be obtained in production, with physical properties greatly exceeding anything that can be secured from an acid bath. Odd shapes may now be electroformed more readily and with superior results in the cyanide electrolyte. According to the author, it is doubtful whether the acid bath will ever produce deposits of comparable quality.

The organic free (considering cyanides as inorganic compounds) PR cyanide copper plating process will substantially reduce many of the difficulties experienced with cyanide copper solutions. Organics may be, and probably are, completely eliminated from the electrolyte. As a matter of fact, it is desirable to maintain carbon on the filter pads to continuously remove any organic which may be inadvertently brought into the solution. Rinsing after plating is improved considerably, and there are no organic decomposition products requiring stoppages for activated carbon treatments.

With reasonable care, excessive anode corrosion is eliminated as a problem even with anode

TABLE IV

Recommended Solution Composition for PR Cyanide Copper Plating

Solution A	Optimum oz per gal	Limits oz per gal
Copper as metal	8.0	7.5 to 9.0
Free potassium cyanide	1.0	0.8 to 1.5
Potassium hydroxide	5.0	4.0 to 6.0
WES-X*	0.8	0.5 to 1.0
Temperature	180° F	170° to 190° F
Solution B		
Copper as metal	11.5	11.0 to 12.0
Free sodium cyanide	1.0	0.8 to 1.5
Sodium hydroxide	4.0	3.0 to 5.0
WES-X*	0.8	0.5 to 1.0
Temperature	180° F	170° to 190° F
Solution C		
Copper as metal	6.0	4.0 to 8.0
Free sodium cyanide	1.0	0.8 to 1.5
Sodium hydroxide	2.0	1.3 to 3.0
Rochelle salt	5.0	4.0 to 6.0
WES-X*	0.8	0.5 to 1.0
Temperature	180° F	170° to 190° F

* WES-X (trade mark) inorganic cyanide copper electroplating addition agent, Westinghouse Electric Corp.

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bags. The current reversal and the lack of organic takes care of this item. Free cyanide can safely be operated below 1.0 oz per gal even in large tanks with anode bags and heavy production schedules.

In table IV is shown the recommended solution composition for PR cyanide copper plating. In the event that the solution is to be a sodium bath instead of potassium, the only changes are in the metal and hydroxide concentrations as illustrated by solution B. Another satisfactory solution is a Rochelle type bath of composition shown as solution C.

There are several general statements which can be made regarding the proper PR cycle to be employed. For large installations, either still plating or conveyorized systems, the average cycle is 15 sec plating and 3 sec deplating. Where greater smoothening is required, cycles of 15 sec plating and 7 sec deplating can be employed. For maximum smoothening, it is possible to employ a cycle of 15 sec plating and 10 sec deplating. With such a sacrificial cycle, it is beneficial to increase agitation so that excess polarization will not occur on sharp corners. Where smoothening is not of great importance but is desirable to speed-up the rate of plating, the cycle may be lowered to 15 sec plating and 2 sec deplating.

It is now possible with the high speed copper cyanide process to greatly smoothen a given base metal. This results in increased plating cost but a greatly reduced overall cost. For example, a given part which was normally subjected to a finishing process which cost in the completed form 37¢, now only costs 23¢. The plating costs were increased from 2¢ to 4¢, but the buffing and polishing costs were reduced from 28¢ to 14¢.

In the past, bright deposits have generally indicated stressed or brittle metal. With the advent of the organic-free PR cyanide copper plating process, stress-free, ductile deposits can be obtained in general production. Steel parts with 0.001 in. bright copper plate as deposited can be bent 180° starting on a vise jaw without any signs of brittleness. It is also possible with this new solution, to exercise some control in the hardness of the deposit. Harder deposits of copper of a high tensile strength can be obtained than have ever been produced in the past. Deposits of 0.040 in., and a great deal thicker, have been obtained with hardnesses of 220 Vickers down to approximately 100 Vickers. In general, it may be stated that the softer deposits are obtained by increasing the free cyanide up to as high as 2.5 oz per gal and decreasing the cycles to approximately 5 sec plating and 1 sec deplating. The harder deposits are obtained at a free cyanide of approximately 0.8 oz per gal and a PR cycle of approximately 15 sec plating and 5 sec deplating.

The process described is applicable to many fields, such as decorative parts, zinc die-castings, the printing industry, the phonograph record industry and heavy deposits generally.

Plating on Carbon Steel

Embrittlement and adhesion of electroplate are factors

THE problem encountered in plating on carbon steel are the same whether it is low carbon or high carbon steel according to Richard M. Wick, Bethlehem Steel Co., Bethlehem, Pa., in a paper entitled "Electroplating on High Carbon Steel." For plating on high carbon steel, particular attention must be paid to the processing steps because of two factors in addition to the requirements for low carbon steel. They are (1) the tendency towards embrittlement and (2) the requirements for obtaining adhesion of the electroplate.

Avoidance of over-hardening in the previous treatment of the parts is essential. Heat treatment should be conducted so as to obtain a clean and scale-free surface. Reliance may well be placed, wherever possible, on the mechanical treatment of hardened steel parts for preliminary preparation for electroplating. In some cases difficulties caused by hydrogen embrittlement may be minimized by baking at 400°F for at least ½ hr.

In pickling hardened steel prior to electroplating, avoidance of the use of sulfuric acid is recommended. Hydrochloric acid is widely preferred, but this treatment also should be held to the minimum. If for any reason smut results from the pickling operation, it should be removed by electrolytic anodic alkaline cleaning or with cyanides.

To obtain adhesion in the degree necessary, reliance is placed on the use of anodic treatment in sulphuric acid.

The procedures for plating on high carbon steel are not specialized. Low internal stress deposits are generally desirable. Springs should not be plated while subject to externally applied stress. In all cases, the time of each step in

surface preparation and electroplating, should be held to a minimum.

The heat treatment after electroplating of high carbon steel parts is particularly directed to the minimization of the effect of embrittlement. Heat treatments recommended vary in time from 1 to 5 hr, and at temperatures from 300° to 500°F, averaging about 400°F.

Nickel Deposition at High Current Density

Current density increases linearly with electrolyte flow

THE theory of limiting current densities applied to nickel deposition which led to the conclusion that it is theoretically possible to plate nickel at rates as high as 8500 amps per sq ft was analyzed in a paper entitled "Electrodeposition of Nickel at High Current Density." The paper, by W. A. Wesley, assistant director, and W. W. Sellers, research chemist, both of the research laboratory, International Nickel Co., Inc., New York, and E. J. Roehl, Thomas Steel Co., Warren, Ohio, was awarded the AES Founders' Gold Medal for the best paper presented at the convention. The rate of deposition given is so high that the practical limit would be set not by electrochemical factors, but by such engineering requirements as prevention of overheating of contacts, electrolyte and cathode, maintaining an adequate rate of motion of the electrolyte versus the cathode surface, etc. In a controlled flow apparatus, sound nickel deposits were actually made at the rate of 0.001 in. in 16 sec from the chloride bath with high anode and cathode efficiencies. Such deposits proved to be less ductile than those made at normal rates but were of good protective value in porosity and atmospheric tests. Electrochemical data were presented which should be useful in designing equipment for high speed nickel plating and even for increasing ordinary rates by providing uniform motion.

The authors' conclusions were: (1)—The limiting current density for sound nickel deposits increases approximately linearly with the rate of flow of electrolyte over the cathode surface. With a flow rate of 750 fpm sound nickel deposits were obtained at cathode current densities as high as 4260 amps per sq ft from the chloride nickel bath.

(2)—At a current density of 4260 amps per sq ft a nickel deposit 0.001 in. thick is formed in 16 sec.

(3)—The Watts bath suffers serious disadvantages in comparison with the chloride bath for plating at very high current densities, namely, poor anode behavior, high electrolyte resistivity (high tank voltage) and a lower limiting current density for sound deposits.

(4)—At the limiting current densities both anode and cathode efficiencies were still approximately 100 pct.

(5)—With a measured electrolyte flow rate of 10 fpm the limiting current densities were 400 and 300 amps per sq ft for the chloride and Watts baths, respectively. Even at this low flow rate it should be possible to double present average nickel plating rates.

(6)—Nickel coatings prepared at very high current densities were less ductile and slightly harder than those made from the same solution at normal rates.

(7)—The protective value of nickel coatings is not significantly lowered by increasing the current density. Panels made from the Watts bath at 300 amps per sq ft were somewhat superior to 50 amps per sq ft panels in resistance to atmospheric corrosion and the salt spray test.

(8)—The maximum rate at which nickel might be plated in commercial practice, assuming a solution flow rate or cathode motion at a speed of 1000 fpm, would not be limited by electrochemical factors but by such engineering factors as voltage needed, overheating of the electrolyte, overheating of contacts, keeping anode-to-cathode spacing small and uniform, and provision of a uniform adequate flow rate or cathode motion.

These abstracts are presented with special permission of the American Electroplater's Society.

New officers of AES, elected at the 1949 convention, are: President, Arthur W. Logozzo, Nutmeg Chrome Corp., who succeeds Samuel S. Johnson; first vice-president, William J. Neill, Columbus Metal Products Co., Columbus, Ohio; second vice-president, C. F. Nixon, Fisher Body-Ternstedt Div., GM Corp; and third vice-president, Franklyn J. MacStoker, Farrand Optical Co., New York. A. Kenneth Graham, of Graham, Crowley & Associates, remains executive secretary.

The International Fellowship Club, the organization of supply houses and firms supplying the electroplating and metal finishing industries, elected new officers for the coming year as follows: President, Rudy Hazucha, Clinton Co.; first vice-president, George Nankervis, George Nankervis Co.; second vice-president, A. P. Munning, Munning & Munning Co.; third vice-president, Al Braun, Agate Lacquer Co. T. A. Trumbour, Finishing Publications, remains permanent secretary.

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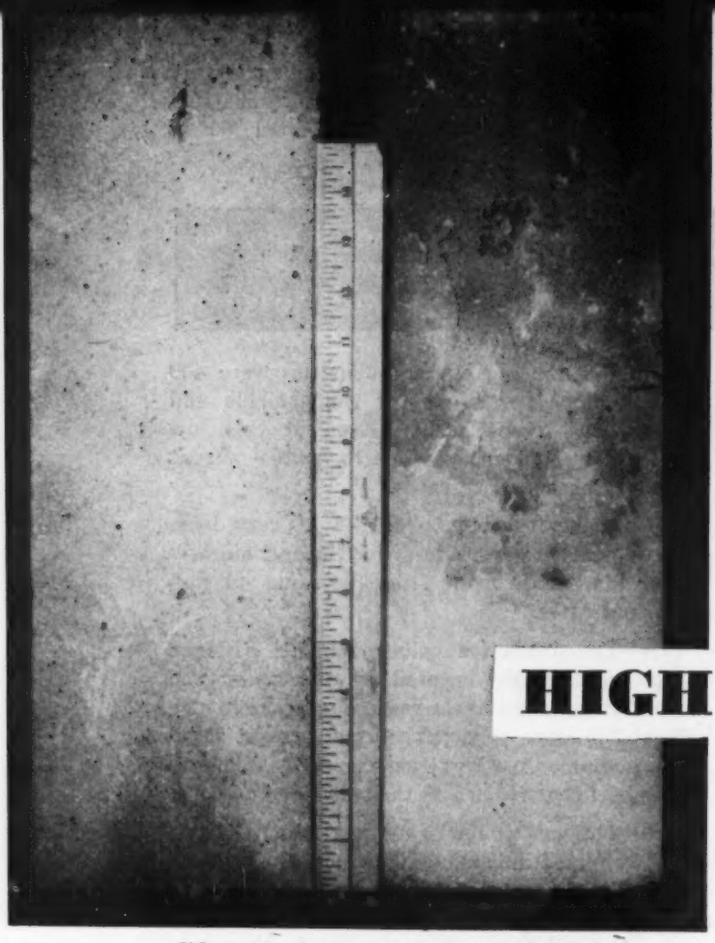

FIG. 1—New high purity magnesia roof brick before and after testing at high temperature.

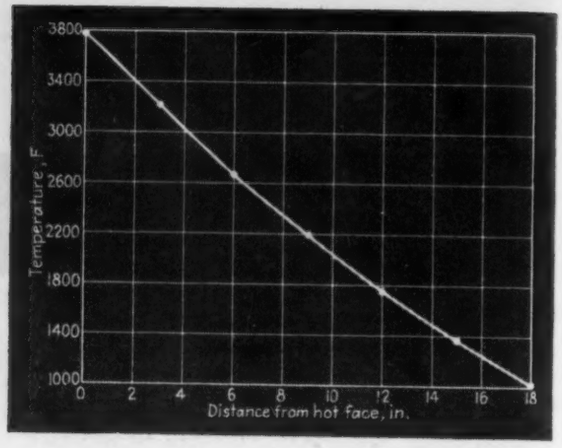

FIG. 3—Calculated temperature gradient in test brick.

HIGH TEMPERATURE

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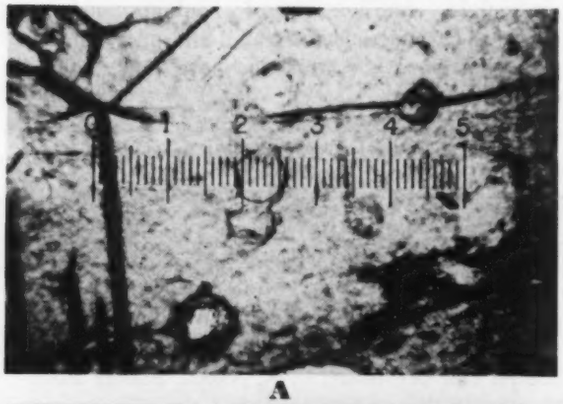

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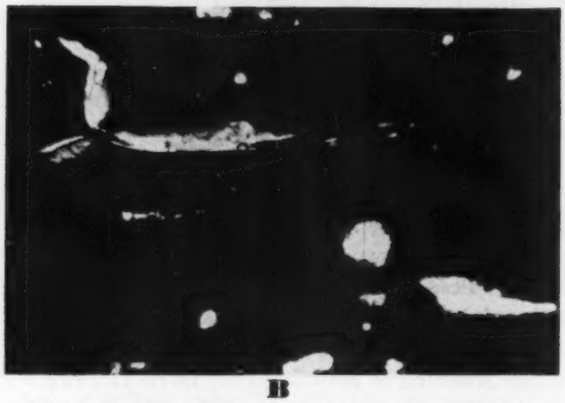

B

FIG. 4—Structure of magnesia refractory, 0 to 1 in. from hot face, subjected to high temperature test. Photomicrograph (A) taken with plane polarized light and (B) with crossed nicols. 50X

THE trend of development in metallurgy with its constant emphasis on higher production rates and higher temperatures, has presented some serious refractory problems. The advent of relatively cheap oxygen to be used in fuels and in speeding metallurgical and chemical processes requires in many cases that service ceilings be raised well above 3000°F.

Familiar types of refractories are living on borrowed time when furnace temperatures exceed 3000°F by any significant margin. A silica roof "weeps great siliceous tears" at the thought of temperatures over 3050°F. Fireclay or high alumina refractories are also rapidly destroyed by these temperatures in the presence of iron oxide. Magnesite or chrome-magnesite refracto-

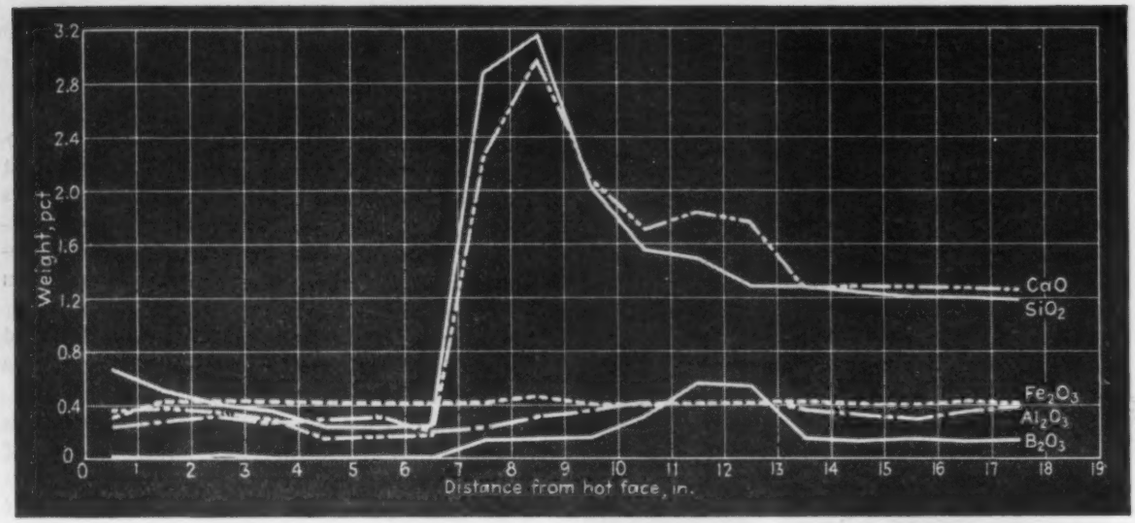

FIG. 2—Chemical analysis of 18 in., 96 pct MgO roof brick tested over 30 days at 3800° F.

PROPERTIES of Magnesia Refractories

SUMMARY: Prolonged exposure of a high purity magnesia refractory to a temperature of 3800°F produces significant changes in chemical and mineralogical character and in physical and thermal properties. Detailed analysis of these changes, correlating quantitative physical and thermal property data with a visual structural study are given by the authors.

ries have had little or no resistance to load above 3000°F, and magnesite bricks have had notoriously poor spalling resistance. Bricks which are predominantly of chromite have a tendency to swell disruptively at temperatures above 3000°F, and this tendency is aggravated by iron oxide.

From published equilibrium data, pure oxides appear to be logical materials to be investigated in searching for improved refractoriness. Of the refractory oxides which are commercially available and economically within reason, magnesium oxide has the highest melting point, reported to be over 5000°F when pure. However, as mentioned above, calcined natural magnesite of refractory grade, which usually contains from 10 to 15 pct impurities, is not satisfactory for service in excess of about 3000°F. In order to secure performance more in line with the theoretical maximum for magnesia, development work has been in progress for some time by the Permanente Metals Corp. on the production of refractory grains and bricks made of the relatively pure chemical magnesia prepared by the reaction of seawater and calcined dolomite.

The view had been widely held among refractory experts that in cubically crystallizing magnesium oxide substantial amounts of impurities were required in order to form a bonding matrix which would tie the rounded crystals together into strong grains, and that otherwise the crystals could readily slip over each other like particles of sand and the grain be easily deformed

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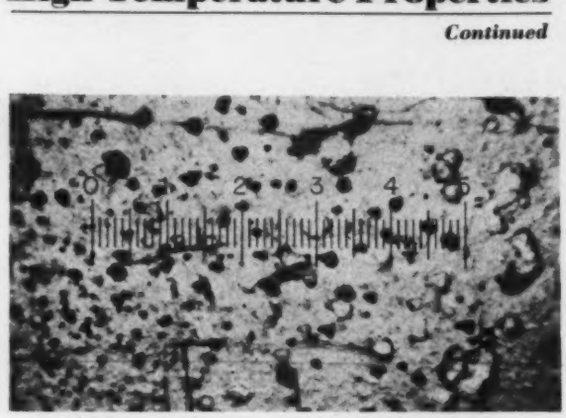
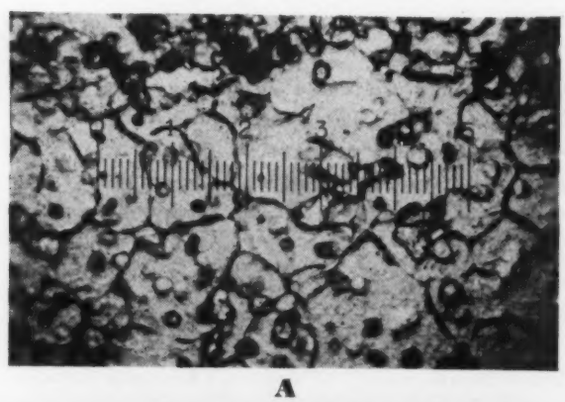


A

B

FIG. 5—Structure of magnesia refractory, 4 to 5 in. from hot face, subjected to high temperature test. Photomicrograph (A) taken with plane polarized light and (B) with crossed nicols. 50X



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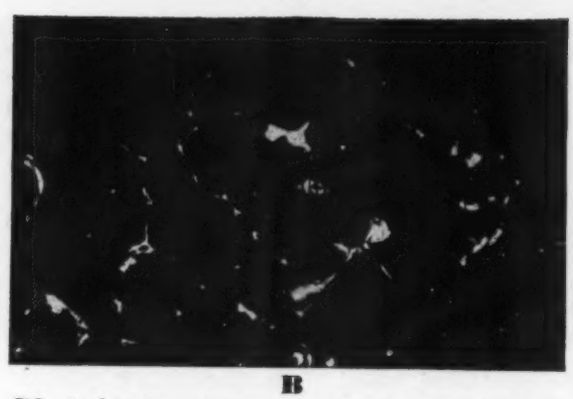


B

FIG. 6—Structure of magnesia refractory 7 in. from hot face. Note concentration of impurities within periclase grains in preference to the bond. Photomicrograph (A) taken with plane polarized light and (B) with crossed nicols. 50X

under load. The only feasible means for preparing stable grains of pure magnesia was thought to be by fusing the oxide. Both of these views have been found to be in error, and well-crystallized and stable magnesia grains have been prepared without fusion. A new refractory has been developed from this magnesia which has better high temperature load carrying capacity and thermal spalling resistance than the more impure magnesite brick.

In order to build better refractories it is desirable to secure a thorough understanding of the processes which tend to destroy them in service. These processes are generally thought of in terms of high temperature, crushing or tensile stresses, thermal spalling, chemical attack, and the like. Since in service the destructive processes are rarely encountered individually, and since the laboratory tests are nearly always of short duration, such tests, if satisfactory, cannot give a final answer but can only serve as justification for testing the material in service. Much can be learned by study of refractories during and after service tests, but it is difficult to analyze the failures and determine the fundamental causes.

Temperature and Concentration Gradients

An excellent example of such a study is that by Zerfoss and Davis on the bursting of chrome-magnesite bricks by iron oxide.[1] This study describes the effects upon the refractories of diffusion of iron, silicon, and calcium oxides at high temperature under the influence of both concentration and thermal gradients. Some difficulty was found in ascertaining the relative effects of the temperature and concentration gradients in the service tests, and as a consequence the laboratory tests were conducted under conditions of uniform temperature.

The converse condition, in which there is a thermal gradient but no external source of impurities or concentration gradient in the refractories, also is of fundamental interest. In order to provide a severe test which would demonstrate the effects of this condition, magnesia refractories which were of uniform composition and low in impurities were used. A temperature gradient from 3800° to 1000°F was attained, and the test was prolonged sufficiently to approximate the duration of actual service. Studies of the chemical and mineralogical alterations and the physical and thermal properties of the high purity magnesia bricks after this treatment are described in this article.

The bricks were formed from carefully grain-sized magnesia whose chemical composition is as follows: 1.20 SiO_2, 1.25 CaO, 0.40 Fe_2O_3, 0.35 Al_2O_3, 0.14 B_2O_3, and 96.66 MgO (difference). The

dimensions of the brick were 18 x 6 x 4½ in. Its weight was 45 lb, and the porosity was about 25 pct by volume. The relatively high porosity was not undesirable since it served to reduce the thermal conductivity, and the high thermal stability of the magnesia grain prevented excessive shrinkage of the brick at very high temperatures. Before testing, the bricks were fired in a tunnel kiln at 2550°F to form a ceramic bond.

For the purpose of the test a roof was constructed of several bricks and suspended over an experimental furnace constructed from magnesia refractories of the same composition as the test bricks. The furnace was fired with natural gas and highly preheated air under carefully controlled conditions so that an oxidizing atmosphere was maintained. Although there were several shutdowns during the test, the warming up and cooling down periods were carefully controlled, and temperature fluctuations during the run were slight. Any chemical or physical alterations taking place in the brick were solely the result of high temperature.

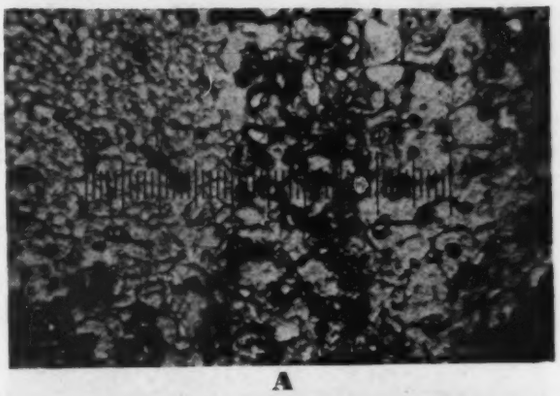
The test was run under the described conditions for 2 months at temperatures above 3250°F and for a month above 3800°F. After the test a representative brick was chosen from the center of the roof for study.

Recrystallization of Hot Ends

A photograph of the tested brick compared with an unused brick is shown in fig. 1. The brick appeared to be in good condition after testing, with only one major transverse crack, about 4 in. back from the hot end. Minor checking was evident on the hot face, and minor transverse cracks had developed in the center portion of the brick. The dimensions of the brick were measured to 1/16 in. to determine the linear shrinkage, which was found to be approximately 1 pct in length and width. The shrinkage was about 4 pct in the 4½-in. dimension, as a result of some side pressure from the walls during the test.

The most noticeable change in the external appearance of the brick was the recrystallization of the hot end. The hot face itself was white to a depth of about ⅛ in., and it displayed the outlines of crystal faces which were up to ⅛ in. in diam. The balance of the brick was brown or tan, and the sides, for about 7½ in. back from the hot face, displayed brilliant crystal faces, elongated perpendicularly to the hot face, and up to 5/16 x ⅛ in. in size. Differences in color and texture indicated distinct zoning in the refractory, with apparent zone boundaries at ⅛, 6, 7½, 9¼, 12½ and 15 in. from the hot face.

The brick was divided into 18 1-in. sections paralleling the hot face, and from these sections 1-in. cubes were cut for chemical analysis, density, porosity, cold crushing strength and mineralogical anlysis. In a similar manner 1 x 1 x 4½ in. bars were cut from each section for modulus of rupture tests. Results of the chemical



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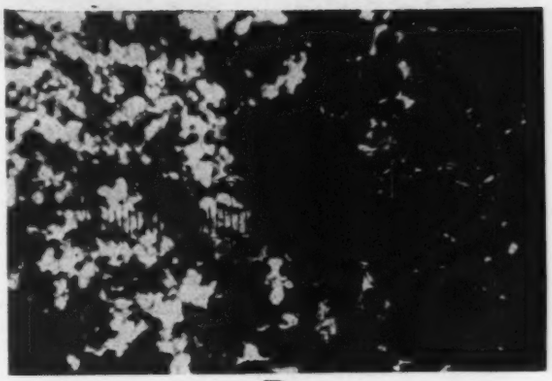
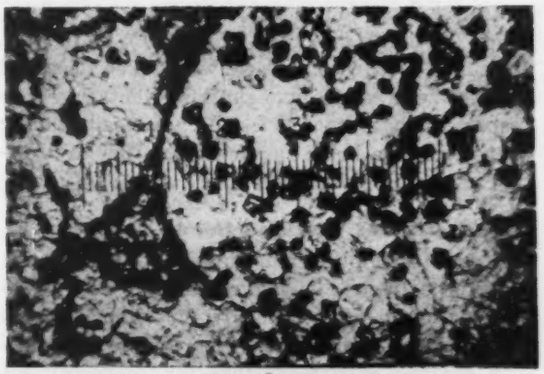


B

FIG. 7—Structure of magnesia refractory 8 in. from hot face. Periclase grains may be seen which show little birefringent material. Photomicrograph (A) taken with plane polarized light and (B) with crossed nicols. 50X



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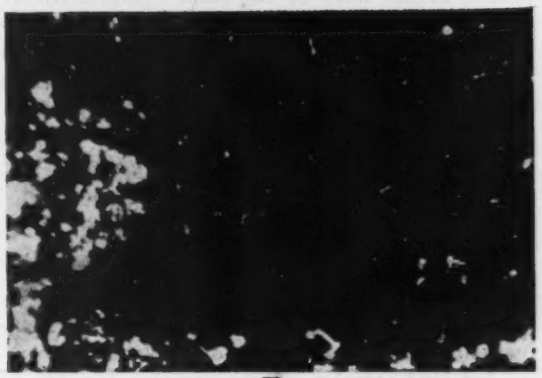

B

FIG. 8—Structure of magnesia refractory 9 in. from hot face. Periclase grains may be seen which show little birefringent material. Photomicrograph (A) taken with plane polarized light and (B) with crossed nicols. 50X

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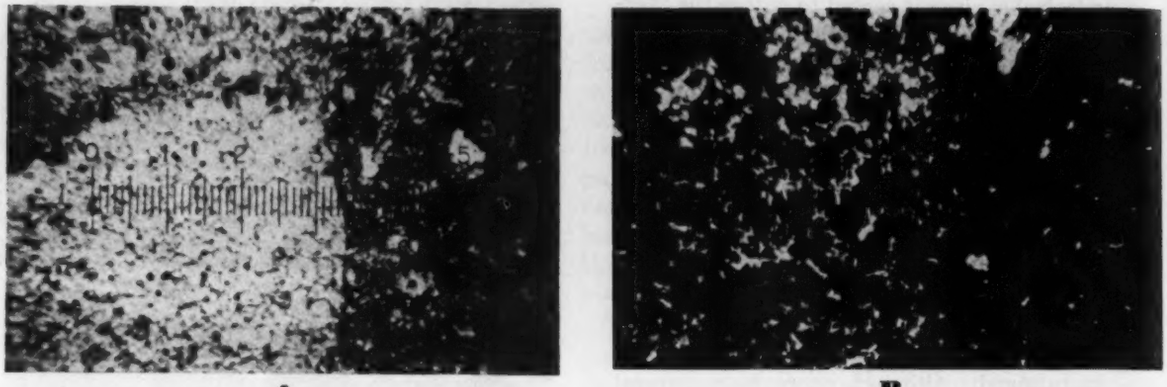
High Temperature Properties

Continued



A B

FIG. 9—Structure of magnesia refractory, 10 to 11 in. from hot face, subjected to high temperature test. Photomicrograph (A) taken with plane polarized light and (B) with crossed nicols. 50X.

analyses are presented in fig. 2, and the results of the tests on physical properties are shown in table I. The calculated thermal gradient through the test brick is presented in fig. 3, in which the temperatures of the hot and cold ends of the brick represent experimentally determined points.

Changes in thermal properties of the test brick were determined by measuring the resistance to load and spalling at high temperature. The high temperature load test was made on samples measuring 2 x 2 x 3 in. that were cut from the test brick from four zones, which were 0 to 3 in., 4½ to 7½ in., 7½ to 10½ in. and 10½ to 13½ in. from the hot face. Care was taken that all samples were cut to have similar orientation with respect to the parent brick, because load-bearing properties of a brick vary with relation to direction of pressing when the brick was formed.

Preparation of Test Specimens

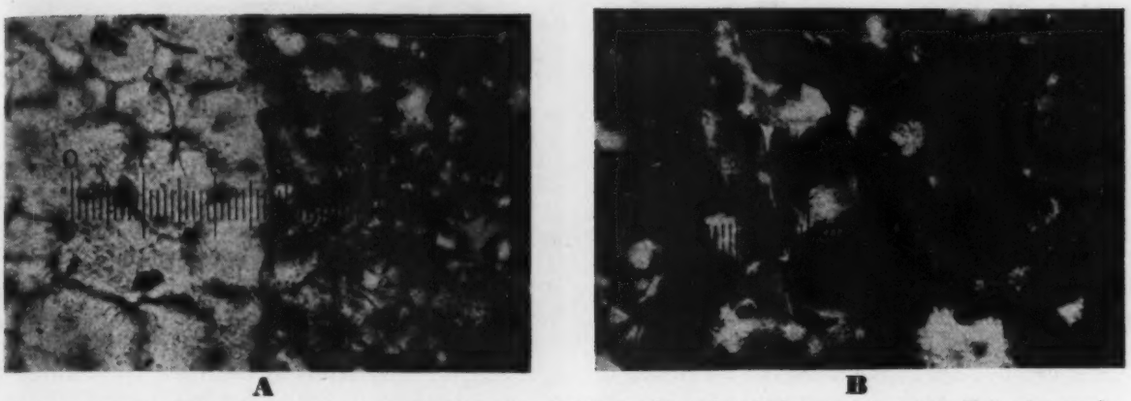
Before testing the samples were measured with a vernier caliper to 0.004 in. The tests were made in a magnesia lined up-draft type kiln, tangentially fired from two burner ports at the bottom with gas and oxygen-enriched air. Pedestal and pusher bricks were of the same composition as the test pieces, but of larger cross-section. Samples were beam loaded to 25 psi, and temperature readings were made on the test pieces with a Leeds & Northrup optical pyrometer. The temperature was raised to 2900°F in 3 hr, and to 3270°F in an additional 45 min. Samples withstanding this temperature were held there for 30 min, then cooled, and again measured with vernier calipers to determine deformation. Results of the hot-load tests are given in table II.

Samples for the thermal spalling test were cut from the same general zones of the brick as were the hot load samples. Three samples, 6 x 4½ x 2½ in. in size, were cut from the unused brick and from each of four sections of the used brick which were respectively 0 to 4½ in., 4½ to 9 in., 7½ to 12 in., and 9 to 13½ in. back from the hot end. Similar samples were cut for comparison from commercial fired magnesite refractories. The samples were laid up in a 20 x 18 in. panel which could be swung alternately before a furnace and before a fan blowing cold dry air. The panel was framed by 5 in. of insulating brick, but the backs of the samples were open to the air. The panel was heated up overnight to 2550°F before the spalling cycles were started. It was then cooled for 10 min in the air blast, and brought back to 2550°F in the succeeding 10 min in front of the furnace, to complete one spalling cycle.

Twelve cycles were run, whereupon the furnace was shut off and two more cycles were run while the furnace cooled down. When the panel had cooled, the samples were removed and weighed, and any spalled portions which could be removed with the fingers, without tapping or prying, were removed. The weight lost as a result of this treatment is reported in table II in terms of percentage of the original weight.

Petrographic thin sections of each of the 18 1-in. cuts of brick were prepared and photomicrographs of a number of them are shown in figs. 4 through 11. Figs. 6, 7 and 8 show sections cut parallel to the hot face at 7, 8 and 9 in. back respectively, and fig. 10 is an enlarged view of fig. 9 showing the boundary between grain and bond. With the exception of fig. 10, which is at 220X, all of the photomicrographs are at a magnification of 50X. At 50X, the full length of the scale shown in the photomicrographs covers 1 mm on the section, and the smallest scale division is equal to 20 microns.

Extensive chemical and mineralogical alterations from one end of the brick to the other are revealed by the analyses and thin sections. The most striking feature is the migration of anisotropic minerals away from the hot end and their concentration in the cooler portions of the brick. Substantially complete recrystallization and tre-



A B

FIG. 10—Structure of magnesia refractory, 10 to 11 in. from hot face, subjected to high temperature test. Photomicrograph (A) taken with plane polarized light and (B) with crossed nicols. 220X.

mendous grain growth of magnesia in the hot end are also notable.

In the thin sections, isotropic crystals of the principal constituent, magnesium oxide or periclase, appear light colored when seen with plane-polarized light, but appear black when seen under crossed nicols. The anisotropic minerals, which are birefringent, are therefore strikingly revealed by the photographs with nicols crossed, since they then show up as bright spots of light. The correlation between the curves of the lime, silica and boric oxide analyses shown in fig. 2 and the amounts of anisotropic minerals indicated by the respective thin sections is immediately apparent. In figs. 6 and 9 concentration of impurities appears to take place within the periclase grains in preference to the bond; in figs. 7 and 8 periclase grains may be seen which show little birefringent material.

Diffusion of Oxides

The anisotropic minerals, principally forsterite and monticellite, were identified by oil immersion studies. Forsterite, $2MgO.SiO_2$, appears to predominate in the hot end of the brick, and monticellite, $CaO.MgO.SiO_2$, appears most abundant in the zone of maximum impurity concentration at about 8 in. from the hot face. In the colder portions the crystallization was not sufficiently developed for microscopic identification.

Chemical analyses of the used brick, shown in fig. 2, indicate that there has been a diffusion of the calcium, silicon and boron oxides. Any thoughts on the nature of the diffusion of these oxides would be merely speculative; however, there are a few conclusions that appear reasonable. Fig. 2 shows that there is a zone of concentration of silica and lime starting 7 in. back from the hot face, and lime and boric oxide starting 11 in. back from the hot face. Since there is a concentration of two oxides in the same place in two sections of the brick, it appears that the oxides must have diffused together, particularly since the lime is concentrated in two different places. This diffusion probably occurred while the compounds were in a gaseous or liquid state, although it is possible that a part of the diffusion occurred in the solid state.

It appears reasonable to assume that diffusion occurred in the liquid phase, since no data are available to indicate that calcium silicate or calcium borate are stable in the vapor phase. This assumption leads to the conclusion that the high temperature liquified the silicate and borate minerals, and under the driving force of a thermal gradient the liquids diffused to temperature zones where their mobility was sufficiently low to preclude movement.

For the calcium and boron oxide combination the highest calculated temperature in the zone of concentration was about 1900°F. An approximate calculation of the material which was deposited in this zone indicates a composition of 24 pct SiO_2, 44 pct CaO, and 32 pct B_2O_3, which is very close to the composition of the eutectic between $CaO.SiO_2$, $2CaO.B_2O_3$ and $CaO.B_2O_3$, which has a freezing point of 1863°F.[3] A calculation of the material which was deposited in the zone of concentration of lime and silica indicates a composition close to the eutectic between monticellite, forsterite and magnesia, which has a freezing point of approximately 2700°F.[3] The highest calculated temperature in this zone was about 2500°F. The boric oxide content in the zone probably could modify the eutectic sufficiently to account for the lower freezing temperature apparent here.

Undetermined minor amounts of other impurities were present in the brick, and they undoubtedly would also somewhat modify the properties of the eutectics. It may be noted that migration has continued past the temperature zone at which the eutectics should freeze, according to the equilibrium curves, and it is possible that this may be due in part to diffusion in the solid state. One should bear in mind that the temperature gradient may be inaccurate by many degrees, having been calculated only to the best of present knowledge, in which the thermal conductivity factors for magnesia are limited to determinations made below about 2500°F.

These observations suggest that calcium, silicon and boron oxides and a small part of the mag-

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nesia may have migrated as liquids whose composition approximated that of the eutectic between monticellite, forsterite and magnesia in one case and the eutectic between $CaO.SiO_2$, $2CaO.B_2O_3$ and $CaO.B_2O_3$ in the other.

Migration of certain relatively low-melting constituents of a uniform refractory composition under the influence of a temperature gradient is revealed. It is believed that this phenomenon has not generally been known, although the zoning of impurities in refractories, which have been exposed to external sources of chemical contamination, has been studied and described. A common example of such zoning is seen in the silica bricks from openhearth and copper reverberatory roofs.[4, 5]

The previously mentioned article by Zerfoss and Davis shows migration of silicate minerals as well as iron oxide. Another example has been described in which migration took place at moderate temperatures from a magnesite brick high in impurities into an abutting brick having lower impurity content.[6] In the references the migration took place under the influence of a concentration gradient, whereas in the present instance the migration appears to be solely the result of the temperature gradient through the brick. The present migration is probably a manifestation in refractories of the Ludwig-Soret effect, which in general terms is the establishment by diffusion of a concentration gradient under the influence of a thermal gradient.

Outside the field of refractories, migration with a temperature gradient is not unknown. When given sufficient thermal agitation for mobility, it is common for small particles, molecules, or ions, to move toward a position of lower thermal agitation, i.e., lower temperature. Thus, colloidal solid or liquid particles in a gas are precipitated selectively upon the colder of two adjacent surfaces with which they may come in contact, as is familiarly shown above a register or radiator by the dirty bands of soot on a plaster wall, which outline the underlying strips of lath. A simple experiment may be performed to illustrate further this principle of migration by coating a strip of glass or metal with oil or wax. When the strip is held level and heated in the center from below, it may be seen that the coating is driven away from the hot spot, often piling up in a small circular ridge. With care, the molten wax or oil may even be made to move uphill.

The photomicrographs show that prolonged heat treatment at high temperatures has increased the periclase crystal size in the refractory grains from an initial maximum of approximately 140 microns to over 5000 microns, while the apparent minimum crystal size has increased from an initial 10 microns to 200 microns or more. Elongation of the magnesia crystals parallel to the thermal gradient is also interesting. Magnesia crystal growth in the periclase grains is evident in all sections within approximately 10 in. of the hot face. This point is also about the end of the zone of lime and silica concentration and, presumably, the end of the monticellite-forsterite-magnesia eutectic migration.

This observation suggests that the mobility of the eutectic, in which magnesia is soluble in

TABLE I

Physical Properties of Magnesia Brick Subjected to High Temperature Testing.

Inches from Hot Face	Bulk Density: G per cc	Bulk Density: Lb per cu ft	Porosity, Pct	Cold Crushing Stress, Psi	Modulus of Rupture, Psi
0-1	2.70	168	24.2	18,500	3600
1-2	2.76	172	22.4	19,300	3800
2-3	2.71	169	23.8	14,800	3500
3-4	2.71	169	23.8	12,900	3800
4-5	2.68	167	24.7	11,200	3200
5-6	2.65	165	25.5	9,680	3000
6-7	2.64	165	25.8	9,200	3500
7-8	2.62	163	26.4	10,100	2100
8-9	2.88	188	19.1	9,700	1650
9-10	2.72	170	23.6	9,300	2800
10-11	2.64	165	25.8	9,000	2480
11-12	2.60	162	26.9	5,500	1700
12-13	2.56	160	28.1	4,600	1350
13-14	2.58	161	27.6	4,500	1200
14-15	2.66	166	25.3	4,200	1100
15-16	2.63	164	26.2	5,900	1800
16-17	2.64	165	25.8	6,600	1808
17-18	2.65	165	25.5	5,900	1900
Original	2.67	167	25.0	8,600	2300
Average Fired Magnesite	2.72	170	24.4	11,800	2800

Dimensions	Length	Width of Hot Face	Breadth of Hot Face
Original Brick	18 in.	6 in.	4½ in.
After Test	17 13/16 in.	5 15/16 in.	4 5/16 in.
Linear Shrinkage	1.84 pct	1.04 pct	4.7 pct

TABLE II

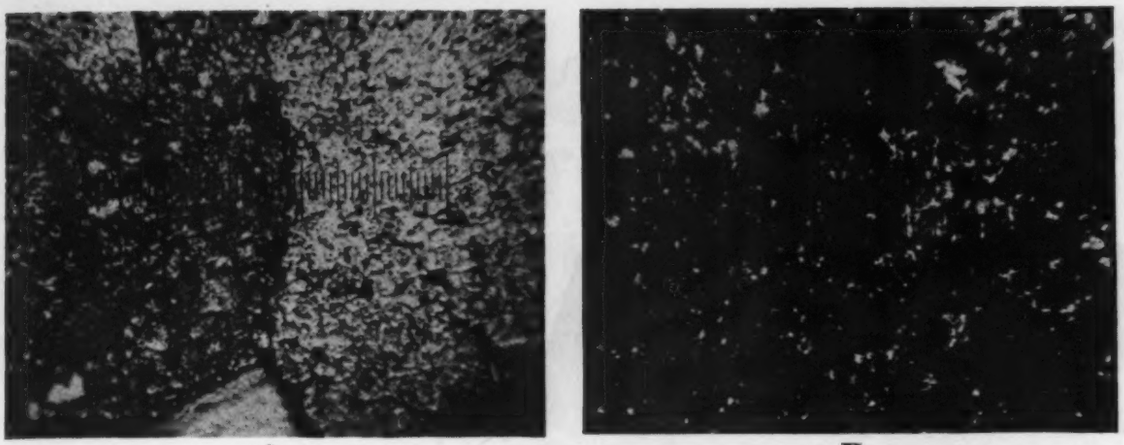
Thermal Properties of Magnesia Brick. Refractoriness Under Load

Section at Stated Inches from Hot End	Maximum Temperature, °F	Deformation Under Load of 25 Psi
0-3	3316	None, ½ hr over 3272°F
4½-7½	3366	None, ½ hr over 3272°F
7½-10½	2932	Sheared
10½-13½	2857	Sheared
Original	3272	Sheared after 3 min
Average Fired Magnesite	2687	Sheared

Thermal Spalling

Section at Stated Inches from Hot End	Average Spalling Loss, Percent
0*-4½	47
4½-9	42
7½-12	23
14-9½	11
Original	7
Average Fired Magnesite	19

* First named figure indicates side of section facing heat on panel.



A B

FIG. 11—Structure of magnesia refractory, 14 to 15 in. from h ot face, subjected to high temperature test. Photomicrograph (A) taken with plane polarized lig ht and (B) with crossed nicols. 50X.

varying amounts depending upon the temperature, has an appreciable effect upon the recrystallization of the magnesia. From fig. 3 it is seen that the estimated temperature at 10 in. from the hot face is slightly over 2000°F. Thus, the apparent temperature for the inception of recrystallization of magnesia under these conditions is about 45 pct of the melting point on the absolute temperature scale.

According to Tammann self diffusion in crystalline matter, which confers the ability to recrystallize, begins at a temperature which is approximately 57 pct of the absolute melting point.[7] The development of elongated magnesia crystals in the brick is terminated at about 7½ in. from the hot face. If it may be inferred that elongation of the crystals denotes migration of the magnesia, such migration apparently ceases beyond that point. The calculated temperature of this point is 2430°F, which is approximately 52 pct of the absolute melting point of magnesia. However, whether the magnesia was able to migrate and recrystallize in oriented elongated crystals after the removal of liquid eutectics, or whether the eutectics produced this effect upon the magnesia crystals by a streaming action during their exodus, is a matter of interesting speculation. It appears more likely that this crystal development is related to the gradual dropping of magnesia out of solution as the liquid eutectic cooled in migrating to the cooler portion of the brick.

Iron and alumina analyses are practically uniform throughout the brick, with the exception of the first ¼ in. back from the hot face, from which much of the iron has been driven. Probably the small amounts of iron and aluminum oxides present in the composition are in solid solution in the magnesia, and are held therein so strongly as to inhibit their diffusion at a different rate from that of the magnesia.

The changes in physical properties of different sections of the brick are the result of chemical and mineralogical alterations. Cold strength of the hottest 7 in. of the brick is much higher than the original brick and varies directly as the amount of recrystallization. The cold strength of the brick 7 to 11 in. back from the hot face is relatively constant and higher than that of the original brick This is the section where the impurities are concentrated and they are acting as a good cold bond. Cold strength of the brick falls sharply in the sections farther back than 11 in. from the hot face. In this zone virtually no recrystallization has occurred, nor are there impurities concentrated to form a strong bond.

The highest density and lowest porosity are found where the impurities of lime and silica are concentrated. These impurities have probably migrated into the voids in this section of the brick, giving a greater weight per unit volume. Bulk density in the sections of brick exposed to the highest temperature varies only slightly from the rest of the brick in spite of the extensive recrystallization. Recrystallization has occurred around the voids of the brick, resulting in very little shrinkage or change in bulk density. This phenomenon is clearly shown in the petrographic thin sections.

Thermal properties of the different sections of the brick have shown considerable change as the result of chemical and mineralogical alterations. Those sections, which had shown extensive recrystallization and had the low melting point minerals removed by thermal diffusion, had improved load-bearing capacity at high temperature, while those parts of the brick that contained diffused silicate and borate minerals and showed recrystallization to a minor extent, had poorer load-bearing capacity than the unused brick.

Degree of recrystallization of the periclase and quantity of silicate impurity are both important factors affecting hot load strength of magnesia brick. From equilibrium diagrams, it has been calculated that test sections 0 to 3 in. and 4½ to 7½ in. from the hot face contained only 2 to 3 pct liquids at the temperature to which they were load tested, while the specimens 7½ to 10½ in.

(Turn to Page 157)

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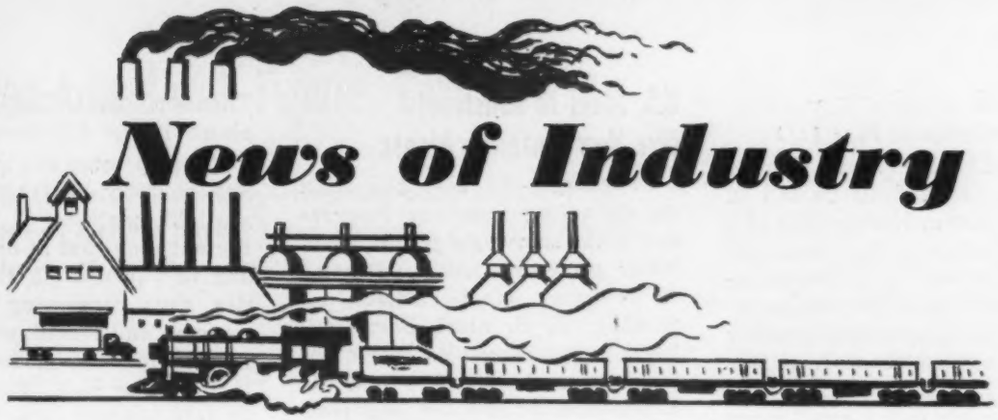

Chicago Tops Pittsburgh

Chicago — Pittsburgh is running second best in recent steel production records. Based on operating rates and capacities, Chicago mills produced 1,381,500 net tons of steel in June this year, while Pittsburgh, its nearest rival, produced 1,257,200 net tons. This is not the first time in recent months that Chicago has shoved Pittsburgh to a secondary position and industrialists here claim it won't be the last either.

A. O. Smith May Build New Mill

Milwaukee—A. O. Smith Corp. is seriously considering building a new pipe mill to make large diameter linepipe. Chances are good that the mill will not be located here. Production will center on pipe 30 in. in diam and over. Conversations with plate suppliers indicate at least two plans are being studied. One is to use wide plates to make single weld pipe, the other it to use two narrow plates, form half circles and produce pipe with two longitudinal welds. Chicago mills can not furnish suitable wide plate and thus the source of plate enters into Smith's final decision. Reports indicate Smith is anxious to get such a mill in production to start pipe deliveries by second quarter 1950. A. O. Smith officials told THE IRON AGE last week that final details are still undecided.

Steel-Union Goodwill Seen on Skids

Murray's action in throwing bargainable subject of wages, insurance into Administration's lap makes steel mad . . . Will hurt future—By TOM CAMPBELL

New York—At the rate the steel industry and the steel workers union are pulling apart it won't be long until all vestige of good fellowship is gone. This is important. It has a bearing on future relationships. And the way things are going now the steel industry is not going to be anxious to be agreeable in months to come.

The maneuver of Phil Murray in throwing what was supposed to be a bargainable subject—wages and social insurance—into the administration's lap has made a lot of steel people as mad as wet hens. The reason is simple. They think price of steel is high enough. The trend of business shows that the seller's market is gone for a long time. And steel also wants to call a halt to the next and the next round of wage increases.

"Ability to pay" a wage increase is something steel circles will have none of. If ability to pay were the criterion they say a lot of steel firms would have no labor and others would have all of it. They insist that the right pay for a job is the worth of the job. And when it comes to wholesale social benefits—paid for by the company—they think the welfare state isn't here yet.

But the thing that burns up most steel people is the way they were sidetracked just at a time when facts and figures were in their corner of the collective bargaining arena. Now they have had to go before an outside board and have it make recommendations on how it ought to run its business. That, say the more conservative steel men, is the road to a social state. And even the so-called liberal steel people are aghast at what the industry is coming to.

The union, on the other hand,

Turn to page 112

Carnegie Mill Struck at Gary

Chicago—At 4 p.m. last Thursday, union pickets arrived at the gate of the Carnegie-Illinois Gary Sheet & Tin Mill asking workers not to report. The union claimed a memorial for a man killed the day before when a coil fell off the transfer car of the cold reduction mill. Out of the 7600 employees at this plant 2400 were working on Friday but pickets were trying to close the mill down tight. The strike ended at 4 pm Aug. 6 after a loss of 11,750 net tons of production.

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Steel-Union

(Continued from Page 111)

is jubilant these days. Having forced the steel firms to fall in with the Truman-Murray plan of a fact finding board they hope and expect the best—a recommendation favoring them. But the shouting may not be over before either side may get a setback from this board.

It is possible that a small wage grant may be recommended plus a more liberal social security package and a flat "No" on pensions. Even though the union would grab at such a recommendation the steel industry might fight it tooth and nail. When it failed to take its stand when the Truman proposal was made it was a foregone conclusion that they would have to take a stand later. And they may do just that with a bang.

But aside from the if, and's and guesses on the board it now looks like future bargaining meetings between steel and the union will be chip-on-shoulder affairs. If the steel industry—with things in its favor—is sidetracked by government intervention, and if when things favor the union the latter gets what it wants, where does bargaining come in, say steel headmen. It looks like it doesn't come in. That's why there is still a chance of a bitter showdown—a showdown that might have big consequences in the business world and may yet force Mr. Truman to use his powers under the Taft-Hartley Act.

Sharon Steel Orders Climb

Sharon, Pa.—A general pickup in business has prompted Sharon Steel Corp to start up a blast furnace and five openhearths at its Farrell, Pa., works, and its blast furnace at the Lowellville, Ohio, plant.

The Farrell plant, which has 14 openhearths and two blast furnaces, had been shut down nearly four weeks, with the exception of finishing mills. At Lowellville, the company now is operating four openhearths, one electric furnace and the blast furnace.

U.S. Steel to Construct Five New Sintering Plants

Pittsburgh—To ease the drain on dwindling iron ore reserves and at the same time permit use of lower grade ores without the risk of lowering blast furnace efficiency, U. S. Steel Corp. will begin work soon on five new plants to make powdery iron ore usable and to recover iron from blast furnace flue dust.

When completed, the new facilities will be able to add about 1.8 million net tons a year of high grade iron ore for U. S. Steel blast furnaces. Production from ten older plants amounted to about 3.4 million tons of sinter last year.

Work already has begun on a sintering plant at National Works of National Tube Co., McKeesport, Pa. Others will be constructed at the Gary, and South Chicago, Ill., plants of Carnegie-Illinois Steel Corp., and at Carnegie's Edgar Thomson and Carrie Furnace plants in the Pittsburgh district.

It was pointed out that the new iron recovery program will make available material of higher iron content than that of ore as mined, and of superior physical properties, thus conserving high-grade reserves and simultaneously making possible the moderate use of lower grade ores. Flue dust has an iron content of approximately 50 pct.

The company estimated that over a 10-year period, a metallics loss of approximately 3 million tons can be traced to the presence of fines in iron ore. Translated into an equivalent amount of ore, this equals approximately the ore requirements of one 900-ton blast furnace over that period.

Decision to build additional plants was prompted by the fact that more dust is being recovered currently than can be sintered by existing machines.

Issues Phantom Tool Orders

Washington — Phantom orders, to enable manufacturers to work out fast production schedules for use in national defense, are being issued by the Government for $74 million worth of metal cutting tools.

These orders are going to 99 active domestic firms. This is the second of such orders, similar ones having gone previously to manufacturers for 100,000 machine tools. They represent equipment which would be needed first in an emergency.

Should an emergency be declared, manufacturers could thus go into production immediately, with the assurance that RFC or a similar government agency would take care of the government's obligation.

Officials of the National Security Resources Board estimate that cutting tool production could be stepped up one-third over 1947 output by going on a full-time, one-shift basis. This could be almost doubled by an extra shift. Three-shifts, however, could only be counted on to increase two-shift output by 60 pct.

AEC May Release More Data

Washington—The Atomic Energy Commission plans to release more industrial and technical information to industry. It has set up an advisory committee of members of the technical press and professional societies to work with Commission officials on the first test program, which is in the field of metallurgy.

Next month a working committee from the advisory group will, after security clearance, examine all metallurgical information which presumably can be released to the public. Recommendations will then be made to AEC regarding the release of material that might be valuable to industry.

Steel Men Armed with Figures, Color Too

Companies may uncork eye-catching color before Fact-Finders to counter catchy union phrases . . . Moreell and Batcheller to testify—By JOHN B. DELANEY

Pittsburgh—The steel industry was scheduled to open its case before President Truman's factfinding board in New York recently, prepared to shoot the works with facts and figures, and with a dash of good old-fashioned color of the headline-catching variety tossed in as an added feature.

Steel company statisticians have been working long hours the last several weeks gathering figures for the No. 1 job of refuting the Nathan Report, which purports to prove that the industry can well afford to grant its employees a 30¢ an hr "package" embracing higher wages, social insurance and pensions.

But the producers are well aware that the learned three-man panel is only a part of their audience. The general public is interested, too. So it is quite likely that company spokesmen will seek to soften the impact of dull statistics with a sprinkling of colorful language that the average chap can understand. It's hard to overlook the word-picture phrases used by United Steelworker witnesses—phrases such as Philip Murray's, "The industry is bulging with profits" and his harsh remark that steel industry management is "The most sanctimonious bank of professional racketeers in this country." Not to mention Murray Latimer's comparison of steelworkers with Tennessee sharecroppers and his reference to U. S. Steel's existing pension system as a "Device for creating unemployment among the aged."

Top flight figures of the industry planned personal appearances before the board. They included Admiral Ben Moreell, head of Jones & Laughlin Steel Corp., and H. G. Batcheller, president of Allegheny-Ludlum Steel Corp. The stern-visaged Moreell and the white-haired, distinguished Batcheller are both capable of turning a neat phrase off the cuff when the situation warrants. U. S. Steel's John A. Stephens, veteran of many battles with the USWA, was expected to carry the brunt of his company's presentation.

While most steel executives preferred to remain silent after the union wound up its case last Wednesday, Mr. Batcheller and C. M. White, president of Republic Steel, said they were not impressed by the union's case.

Steelmakers Not Impressed

"Nothing was presented by the union which in my opinion refutes the wisdom of our original decision turning down the demands for a fourth round of wage increases," Mr. White said. He reiterated that 1949 wages cannot be paid out of 1948 profits, and pointed to Republic earnings for the second quarter, off 33 pct from the first quarter, and third quarter orders that indicate an even further drop. "To deliberately increase the cost of steel production under these conditions would be the height of bad judgment," he added.

Inland Steel's president, Clarence B. Randall declared that "there is no way whatever by which the steelworkers can get

(Turn to Page 114)

Board Hears U. S. Officials

New York—Deliberations of the steel fact-finding board took an unusual turn last week when the three-man panel held informal discussions with government experts from the Commerce and Labor Depts. The discussions centered around the availability of certain factual material with which the board members hoped to test the reliability of the testimony.

This move has been interpreted to mean that the board is not going to rely entirely on the formal testimony and that its findings are determined to come up with impartial findings may be based in part on facts gathered from sources other than the CIO and the steel industry. It is expected that the government experts will again be called in when the steel industry has completed its presentation.

JUNIOR ACHIEVEMENT AWARD: An award to Armco Steel Corp. as the nation's most outstanding sponsor of Junior Achievement companies was presented to Charles R. Hook, chairman of Armco by the Chamber of Commerce of the United States. Left to right: Earl O. Shreve, president-elect of Junior Achievement, Inc., Charles R. Hook and Robert L. Lund, past president of Junior Achievement, Inc.

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Steel Hearings

(Continued from Page 113)

more money without having that money come out of the pockets of the public."

The lull between close of the union's case and start of company arguments was enlivened by an exchange between Messrs. Stephens and Murray over whether pensions are a bargainable issue this year. Mr. Stephens said it was agreed last year that pensions would not be discussed at this time. Mr. Murray replied that no such agreement exists—that the union has "no secret understandings with Mr. Stephens on this or any other issue." Existing union contracts provide for reopening on wages and social insurance, but the union says pensions are wages.

The controversy is deep-seated and important, because the stature of both men is at issue. It is definitely a matter of principle that some observers fear is likely to wipe out the mutual respect and satisfactory relationships that have been built up between top-level leaders of the union and the company.

It would not be surprising if the question produces fireworks when raised before the panel.

No one was hazarding a guess, for the record, on what the fact-finding board will recommend. And neither would anyone say what will happen when the decision is announced. "Let's wait and see," was a popular reply to such questions. The board must return its decision by Sept. 1. The findings will not bind either party.

Police Halt Union Violence

Chicago—One man was injured and three arrested when violence broke out at the gates of Republic Steel Corp.'s plant here on Aug. 2. The scuffle was the result of efforts of 50 or 60 union members to sign-up non-members on the day shift at the plant. It ended quickly after 22 policemen were rushed to the scene.

The union men were members of the United Steelworkers of America, CIO, which has a contract with Republic at the plant. However, it is an open-shop. The drive for new members at Carnegie-Illinois' South Works started Aug. 4.

EMERGENCIES: Oxygen apparatus that has been added to the emergency center of the Spang-Chalfant Div. of the National Supply Co. This device is known as a Pneophore, administers oxygen to victims of electrical shock, irritant gases, carbon monoxide poisoning and other respiratory conditions.

Crystal Balls Gather Dust in Chicago

Some see steel emerging from a prosperous recession while others are gloomy . . . Few steel men will bet on strike or fourth quarter—By D. I. BROWN

Chicago—According to some, the steel industry is emerging from the most prosperous recession on record. Others believe the worst is still ahead. The optimists point to the recent pickup in steel buying as proof. The sad ones point in all four directions at once, naming consumers who are still cutting back or may cut back production very soon.

Crystal ball gazing has been passe here since Nov. 5, 1948. Few steel men are prophesying. Nobody will wager either way on a strike or fourth quarter operations, so that all told the conversations at lunch are quite dull—except on scrap prices.

The increased activity by steel buyers in this area in recent weeks, which filled most mill order books for third quarter, was a surprise. A little over a month ago the mills did not expect to operate as full as it now appears they will. The reason for the buying spurt is three fold. (1) Buyers suddenly became convinced that steel prices would not go lower. (2) Inventories had become dangerously low. (3) Advance buying as a hedge against a possible steel strike in September.

Auto Orders an Exception

The importance of the relative affects of each of the three reasons on mill bookings are in the order listed. One exception to this is found in orders from the automotive companies. On the whole, this group is specifying delivery on or befor Sept. 15 to a much greater extent than are other customers.

By industry, railroad business is still dead. Small cutbacks in implement production appear to be the forerunner of a further decline. Sears, Roebuck & Co., a highly respected merchandiser here, cut implement prices 2 weeks ago—and that didn't help increase the optimism of midwest implement makers. A check on forgers and foundries supplying both railroad and implement accounts verify the reports from steel producers.

Appliance production continues to improve. In this field the price

shakeout, sales campaigns and steady but not frantic demand has taken the slack out of inventories on most household items.

Dollar-wise general construction in the Chicago area is only 12 pct below the same period last year. Numerous projects are still held in abeyance because of high cost, but state, municipal and government lettings have remained fairly high. The oil industry's steel requirements have been slowed but not stopped. Should the price of Texas crude fall, Chicago observers expect steel demand from this group to decline sharply.

Linepipe Backlogs Excellent

The gas industry continues to shout for linepipe and most other items. Deliveries are much better on all pipe, but excellent backlogs exist for linepipe with all companies producing this item.

Financial and security houses recently voiced a little optimism. They haven't yet backed it up across the board but risk capital in the durable goods industry is available for any venture of good merit. The Federal Reserve System is not worried over the increase of business failures in this, the Seventh Reserve Area. They say that what happened in all other areas just started to happen here, it was inevitable, it is not serious, and if anything, it was overdue.

Bullish tendencies in the scrap market here are not caused by a very large increase in demand now, or in the near future. The strength is real, however, and is an upward adjustment of prices which in the rapid decline went below the actual values and are now returning to a more normal relationship to supply and demand. The steel mills with good scrap inventories, plenty of pig iron and blowing time at the bessemers which can make synthetic scrap, have an effective brake to prevent runaway scrap prices. Nothing short of a national emergency or a repetition of the postwar steel shortage could cause scrap to return to last year's record prices.

European Steel Industry Receives Modernization Funds

Washington — Long-range programs approved so far for increasing industrial and raw materials production in Marshall Plan countries total $780 million. These programs are centering attention on building up the broken down European steel industry.

Of this amount, about 80 pct of the total has been authorized for expenditure with three countries —$303 million for the United Kingdom, $190 million for France, and $145 million in Turkey.

The amount now authorized for steel facilities is but a start on the overall long-range program. Among other results expected by ECA is the increase of steel production in Western Europe to around 45 million metric tons by 1953.

By that date, the European steel consumption is expected to be around 39 million tons, theoretically leaving an exportable surplus of about 6 million tons.

Nearly all of the ECA contribution to the steel expansion program or about $400 million would be spent in the United States in the form of equipment and machinery.

The ECA does not yet have sufficient data to permit a detailed breakdown of proposed capacity by types of finished steel. However, to date the emphasis in ECA steel investments has run strongly to equipment for producing sheet, strip and tinplate.

Under the program as now seen, output of these three types of products would be boosted by at least 6 million tons a year, some officials estimate.

Warehouse Activity Slips

Chicago — The strike threat spurt in warehouse business has tapered off. Little forward buying out of warehouse exists at the moment. Consumer buying just prior to July 16 made July a good month for bookings at most warehouses in this area. Subsequent reordering by warehouses from mills has also been partially responsible for the extension of mill promises.

Galvanized sheets continue to be the hardest item to obtain from warehouses. Mill promises are running late October and in some cases schedules are filled to November. Cold-rolled strip is the easiest item to get. In fact, large warehouses are being undersold by their smaller competitors in cold-rolled strip items. Such prices are simply mill base, plus freight, plus extras with little or no markup.

Conversion warehouses now out of that business, are also active in strip. They buy cold-rolled sheets and slit, some of them edge, and cut the standard rolled strip price as much as $1.50 to $2.00 a 100 lb. Credit is becoming more of a worry as many small users are short on ready cash.

VEST-POCKET LANDING STRIP: A flywheel for brake and tire tests by Air Force engineers at Wright Field on high-speed planes landing at up to 250 mph is under construction at Adamson United Co., Akron, Ohio. The airplane wheel and tire will be pressed against a heavy flywheel rotating to simulate the desired landing speed and then braking the airplane wheel until the flywheel comes to a stop.

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INDUSTRIAL SHORTS

Transplanted—The REPUBLIC STEEL CORP. has moved its Los Angeles office to 624 General Petroleum Bldg., 612 So. Flower St. Telephone: Michigan 5144.

Thomas' New Mill—THOMAS STEEL CO. will spend $1,200,000 on installation of a new tandem cold reduction mill at Warren, Ohio, having an approximate 2000-ton monthly capacity. The mill is scheduled for completion by 1950.

New Company—The organization of the MAURAY I. COHEN CO., with principal offices at 150 Broadway, New York, has been announced.

Far West Agent — HENGER-SELTZER CO., Los Angeles, in new and larger quarters and with greater sales staff, has been appointed as West Coast sales distributor for a number of products made by Fansteel Metallurgical Corp., North Chicago, Ill. and its wholly-owned subsidiary, Weiger Weed & Co., Detroit.

Amplex Products — The AMPLEX MFG. CO., Detroit, Oilite Div. of Chrysler Corp., is mass-producing finished machine parts from stainless steel powders. Among the first precision parts produced from stainless steel by Amplex is a 1-in. cam for an application where contamination cannot be tolerated. They are also equipped to produce larger units. Amplex also manufactures Oilite bearings and permanent filters from stainless steel powders.

New Designation—Kaiser Co., Inc., Oakland, Calif., has taken a new name—KAISER STEEL CORP. The old title was adopted by the company in 1941. The firm believes the new corporate name will more readily identify the type of business.

Laundry News—The American Washer & Ironer Manufacturers' Assn. has been changed to AMERICAN HOME LAUNDRY MANUFACTURERS' ASSN. F. M. Mitchell, Dayton, manager of Frigidaire laundry equipment divison of GMC, who proposed the change, believes the association's objectives are better expressed by dropping all product identity in the organization's title.

Faithful Service — Thirty-eight senior and junior service medals have been awarded to employees of the Trenton, N. J. plant of AMERICAN BRIDGE CO., including one 40-year medal and one 35-year medal.

Need O-rings?—NIELSEN HYDRAULIC CO., New York, has been appointed distributor for O-rings manufactured by the Parker Appliance Co., Cleveland.

An Even Dozen—SOUTHERN STATES IRON ROOFING CO., Savannah, is opening 2 new branches, 1 in Atlanta and 1 in Louisville, numbering 11 and 12 for the company. These are part of a large-scale expansion program. Two additional branches are to be opened within the next 3 months.

More Lamps In P. I.—E. Roland Schoch sails Aug. 25 for Manila to become technical adviser to the PHILIPPINE ELECTRIC MFG. CO., a lamp-making licensee of Westinghouse Electric International Co.

A Southern First—H. McKinley Conway, Jr. of Alabama, has been named as first director of the SOUTHERN ASSN. OF SCIENCE & INDUSTRY, a regional non-profit, non-political group devoted to promotion of industrial research as a solution to Southern economic problems.

Marines Get Lustron Houses

Washington — The first large-scale order for Lustron houses has been completed at the Marine Corps School, Quantico, Va. The project involved 60 of the widely-publicized all-steel houses, 35 for enlisted personnel, 25 for officers. Half have three bedrooms, a feature not yet available to the civilian buyer.

Meanwhile, Lustron's financial situation has again received an airing by a Congressional committee. Lustron president, Carl G. Strandlund, told the House Banking Committee that the firm has operated at loss of $14,754,000 since it was established over 2 years ago. He added that it was expected that receipts would begin to equal expenditures within the next 90 days.

It was also brought out that the firm might have to seek additional working capital within this period. Up to this time the government, through the Reconstruction Finance Corp., has provided practically all the money invested in the firm, about $35 million.

Mr. Strandlund told the committee that while Lustron has produced only some 1200 houses to date, it expects production to soon reach 35 a day at the firm's huge Columbus, Ohio, plant.

U.S. Homes Need More Bathtubs

Pittsburgh—With autumn and chill Saturday nights just 2 months off, it behooves us to give some thought to the problems of the 13 million bathtub-less homes in the United States.

Edward Mackasek, managing director of the Porcelain Enamel Institute, told members recently that not only are there 13 million American homes minus modern bathtubs, but as many as 8 million homes are without running water.

The market's wide open, says Mr. Mackasek, for new plumbing fixtures. Last year the industry produced 1.9 million bathtubs, over 2.5 million kitchen sinks and over 3 million water closets and lavatories.

New England Manufacturers Expect '49 Sales to Drop 15 Pct

Textiles and Shoes are Expected to pick up

Boston—The average New England manufacturer expects his 1949 sales to fall 15 pct below that of last year. This is revealed in a survey sponsored by the New England Council and analyzed by the Federal Reserve Bank of Boston in the bank's monthly review.

The expected 15 pct decline exceeds the average decline of 9 pct in the first quarter and indicates the manufacturers expect business conditions to get worse before they get better.

Cooperating with the Federal Reserve Bank and the New England Council in the survey were nine manufacturers' associations. A total of 605 firms representing about 20 pct of the region's manufacturing employment responded to the mail questionnaire.

Several trends were disclosed by the survey. Two of the most important are the prospective sales improvement in textiles and shoes and the anticipated further decline in durable goods sales.

While most industries expected that their sales for the year would register a greater decline than was experienced in the first quarter, textiles and shoes were the leading exceptions. Dollar sales in textiles were typically down 20 pct during the first quarter, but manufacturers expected a decline for the year of only 15 pct. Shoe sales were down 5 pct during the first quarter, but producers felt there would be no decline for the full year.

The manufacturers of so-called "hard" goods who initially had withstood the downturn in business activity, were the most pessimistic of all concerning sales for the current year. By and large they expected much larger declines for the full year than they had experienced in the first quarter. For example, stone, clay and glass producers, who had no decline in the first quarter, thought their sales for the year would be off by 10 pct. Manufacturers of electrical equipment, who likewise had no decline in the first quarter, expected their annual sales to decline by 15 pct.

Fabricated metal products manufacturers (for example, hardware, heating equipment, metal containers, nails, screw machine products, stampings) anticipated that their first quarter decline of 8 pct would reach 20 pct for the full year, and primary metal products manufacturers (for example, iron and steel, nonferrous metals) expected their decline would move from 15 to 25 pct for the comparable period.

Similar declines were anticipated by producers of nonelectrical machinery and of furniture and finished lumber. Producers of lumber and basic timber expected their first quarter decline of 15 pct to remain the same for the year.

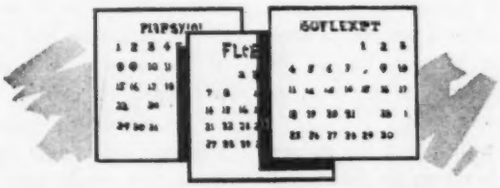
Total Marshall Plan Aid Reaches $5.9 Billion by July

Washington—Through mid-July, total authorizations under the Marshall Plan amounted to about $5.9 billion. Reported paid shipments approximated $4.2 billion.

About 67 pct of all procurements were authorized for supply by the United States and 14 pct from Canada. Another 10 pct was authorized for purchase from Latin America while the ECA nations themselves were to barter 4 pct among themselves.

In exchange, as of July 15, the United States had been shipped or given contracts for the following critical and strategic materials:

Rubber, 26,000 long tons; sisal, 12,000 tons; industrial diamonds, $4.5 million worth; sperm oil, platinum and others from the U. K., $2.5 million; 200,000 ounces quinidine; 10,000 tons of palm oil; 19,800 metric tons of graphite flakes and fines.



Dates to Remember

Sept. 12-16	**Instrument Society of America,** conference and exhibit, St. Louis.
Sept. 14-16	**Porcelain Enamel Institute,** annual forum, Columbus, Ohio.
Sept. 25-Oct. 1	**American Institute of Mining & Metallurgical Engineers,** midyear meeting, Columbus, Ohio.
Sept. 26-28	**National Electronics Conference,** Chicago.
Oct. 3- 5	**American Coke & Coal Chemicals Institute,** annual meeting, Skytop, Pa.
Oct. 4- 6	**Industrial Packaging & Materials Handling Exposition,** annual convention, Detroit.
Oct. 10-14	**American Society for Testing Materials,** West Coast meeting, San Francisco.
Oct. 12-15	**Electrochemical Society,** semiannual meeting, Chicago.
Oct. 13-15	**Foundry Equipment Manufacturers Assn.,** annual meeting, White Sulphur Springs, W. Va.
Oct. 17-21	**National Metal Congress,** Cleveland.
Oct. 24-26	**American Gear Manufacturers Assn.,** annual meeting, Chicago.
Oct. 27-28	**Porcelain Enamel Institute,** annual meeting, French Lick, Ind.
Oct. 31-Nov. 3	**American Institute of Steel Construction,** annual convention, White Sulphur Springs, W. Va.

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Viewing the News from

The ECONOMIC SIDE

By JOSEPH STAGG LAWRENCE

All Horsepower

THE echoes on the Atlantic Pact debate had scarcely died down in the Senate before the White House submitted a program of military aid to the signatory powers plus further help to Korea, Greece and Turkey. The bill—$1,450 million. Although the State Department had thoughtfully prepared a 15,000-word brief in support of the military aid program, the top spokesmen of the armed services were unable to tell a Congressional committee where or how the money was to be spent.

There may be a case for MAP. Perhaps it is prudent for this country to extend substantial material aid to our potential allies against the aggressor who has stepped into Hitler's shoes. This may be an appropriate and foresighted corollary to the Marshall program which aims to promote in Western Europe an economic road-block in the path of the Soviet power push.

The haste with which the money for such a program is demanded long before any clear understanding is achieved as to who does what, when, where, and to whom, is disturbing. It carries more than a faint suggestion that our government is hell bent on getting all the money it can and is using every possible pretext for prying out of a reluctant Congress the maximum of appropriation.

This objective and the technique of critical urgency is entirely consistent with other parts of the Fair Deal program unveiled since the first of the year. The Brannan plan calling for low prices to consumers and high prices for farmers has already been turned down by Congress. No one professed to know how much this program might have cost—a fact that did not seem to deter the Administration in its insistence that Congress approve it. Its application to a single farm product—hogs—might have cost, according to competent students, not less than two billion.

In other parts of the Fair Deal program—public housing, socialized medicine, veteran aid, old age and unemployment relief, higher minimum wages—the government enthusiastically commits itself to vast public expenditures. In his last message on the state of the union, the President abandoned his demand for higher taxes but failed significantly to suggest any economies that might maintain a balanced budget.

The basic philosophy that runs like a sinister red thread throughout the plans of this government calls for greater expenditures on all fronts. Nowhere is there the slightest disposition to retrench. The Truman administration is carrying on the most characteristic and least successful device of the New Deal—deficit financing and pump-priming. If the present Administration had succeeded in getting approval for all its spending proposals, it is certain that the budget for the current fiscal year would have exceeded 50 billion.

The meaning of all this is clear. The public debt at the end of the war reached a peak of 276 billion. Surplus war funds and excess revenues since the end of the war have reduced this total to 251 billion. For some years to come the public debt will move in the other direction. Silly prejudices in favor of solvency will not stay the spending lust of the state. If the public debt must be increased to keep the income stream at full flow, the debt will be increased.

Henceforth the mechanism that runs the state will be all horsepower and no brakes. This has never worked for an individual or a corporation or a state or a local government in this country. It does not seem to be working at the moment for England. But we, the great, wealthy U. S. A.—we are different.

Resumes Cutting Fluids Work

Detroit—The Independent R Search Committee On Cutti Fluids is resuming active wor under the chairmanship of Josep Geschelin.

Founded 10 years ago to assis in the preparation of authorita tive articles and accumulation o data covering the utilization o cutting fluids and the preparatio of machinability tables, it i planned to expand the member ship of the committee in the nea future.

The committee plans to surve and publish up-to-date data o current cutting fluids practice. Th IRC program will not duplicate ac tivity by ASTM and ASME on cut ting fluids, Mr. Geschelin said.

Presents Magnesium Program

Midland, Mich.—Dr. George H Found, manager, technical servic and development of the Magnesi um Div., The Dow Chemical Co. Midland, Mich., and J. B. Reid o Dow's New York office, recentl presented a program on magnesi um at a Design Seminar held a Lehigh University.

The program covered the his tory of magnesium, economics availability, methods of produc tion, shop methods and fabricat ing procedures. The availabilit of magnesium as a substitute fo other materials as well as a com plete discussion of the economic position of magnesium compared with other finished products was included in the program. Case his tories and magnesium exhibits were used during the discussion.

Mullins Mfg. Earnings Dip

Salem, Ohio—Mullins Mfg. Co. has reported net earnings of $1,- 298,825 for the first half as com pared with $3,113,125 for the first half of 1948, the company's big gest year. Net sales dropped to $15,224,593 from $22,929,609 a year ago.

Makes Suggestions to Help Lift New England Out of Slump

Boston—Among the Rhode Island industrialists who joined with other members of the New England Council in making recommendations to Secretary of Commerce Charles Sawyer designed to help lift the New England area out of its current business slump, was Frederick S. Blackall, Jr., treasurer and general manager of the Taft-Pierce Mfg. Co. Woonsocket, R. I.

Mr. Blackall suggested that New Englanders do not want the government to indulge in "make work" programs. "We don't want to try to lift ourselves by the bootstraps. It might bring temporary relief but the reaction would result in new lows."

Instead, he recommended the enactment of sound tax legislation relating to depreciation allowances and in that connection suggested that the taxpayer be allowed to set his own depreciation rates.

In the long run, he said, it would make no difference to the federal government's tax revenue. If it is politically inexpedient to permit such procedure, Mr. Blackall would not object to a 5-year floor except where the taxpayer could prove conclusively that the physical life of his property was less than that.

Reserve Should Be Deduction

Mr. Blackall further suggested some consideration of replacement reserves as a tax reduction in order to bridge the spread between the cost of equipment acquired years ago and its present replacement cost. The present provision of the tax laws that depreciation shall be taken to the extent earned or allowed, with emphasis on the "or allowed" should be eliminated, according to Mr. Blackall.

Should a firm lose money this year, it must still add depreciation or it can never recover that portion of its capital investment. Mr. Blackall was quite pointed about government officials encouraging a fourth round of wage increases.

He pleaded business be given a chance to adjust to the present scale of 200 to 225 pct above prewar levels. Business cannot get prices down if the largest factor, labor, continues to get more wages.

All is not glum in New England business circles. Admittedly, this was the first area to feel recession pains. But many believe that it will be the first area to rebound.

Sees No Justification For Steelworkers Wage Increase

Chicago—Edward L. Ryerson, chairman of the board of Inland Steel Co., in a report to stockholders declared, "No wage increase is justified at this time for steelworkers," and said that substitution of "politically appointed boards for collective bargaining is not a good thing for the country." He called the stockholders attention to the general business conditions, the decline in the cost of living and future earning prospects. He pointed out that the company's net earnings for the second quarter were off 24 pct while sales dropped 10 pct.

Mr. Ryerson explained that earnings for the second quarter of 1949, as in the first quarter, were adversely affected by inventory losses, also by lower rate of operation in Inland's warehouses and fabricating subsidiaries.

Discussing labor, the chairman of the board recalled, that the United Steelworkers of America recently refused a company offer which he termed, "the most generous in industry anywhere." "What Inland in fact offered to our workers was in substance the same program of insurance and retirement benefits which have been in effect in the company for some years." Mr. Ryerson went on to say, "We know of no better plan anywhere in the steel industry."

Dow Earnings Up $4 Million

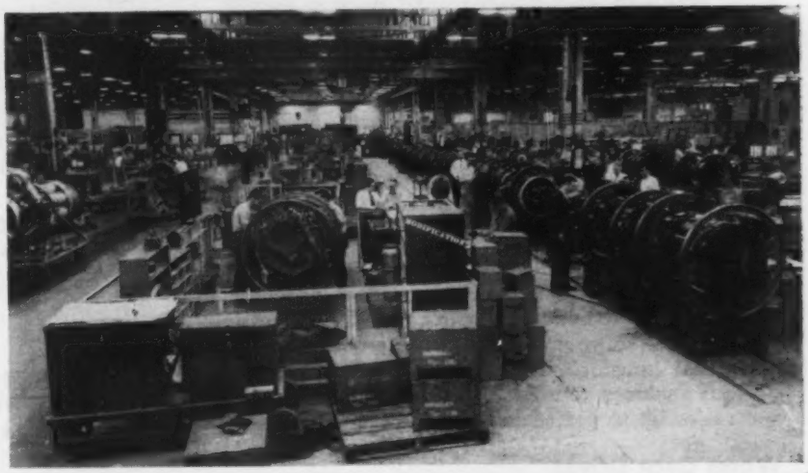
Midland, Mich.—Earnings of Dow Chemical Co. for the fiscal year ended May 31 increased from $21 to $25 million, according to Leland I. Doan, its new president.

After dividends on preferred stock, this is equal to $4.44 per share compared with $3.72 earned a year ago.

During the year Dow sales increased from $171 million to $200 million, and the company's assets increased from $271 million to $294 million.

Mr. Doan succeeded Dr. Willard H. Dow, who died in an airplane accident last Mar. 31.

AMERICAN AIRPOWER: Jet engines, being readied for delivery to the U. S. Air Force, are shown on assembly lines in General Electric's aircraft gas turbine plant at Lynn, Mass. The J-47 turbojets are already in use in three different types of military aircraft—the North American F-86 and B-45, and the Republic XF-91.



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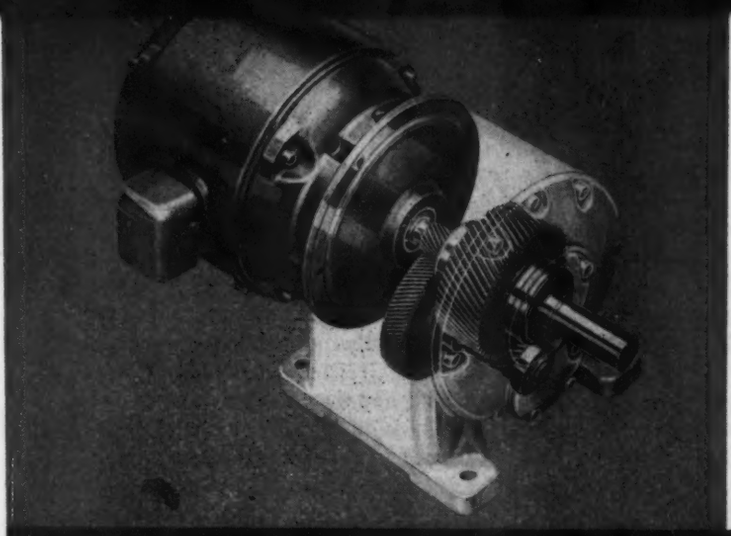
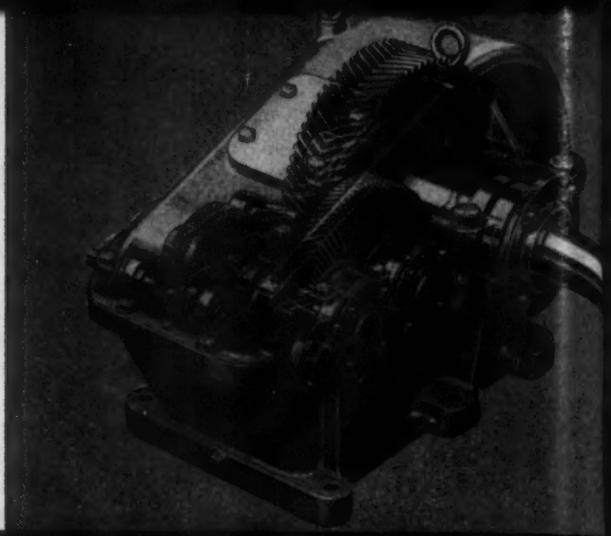
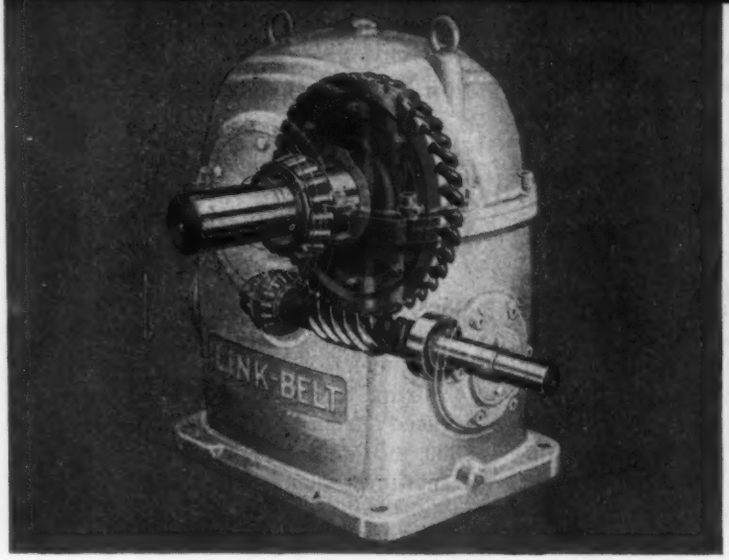
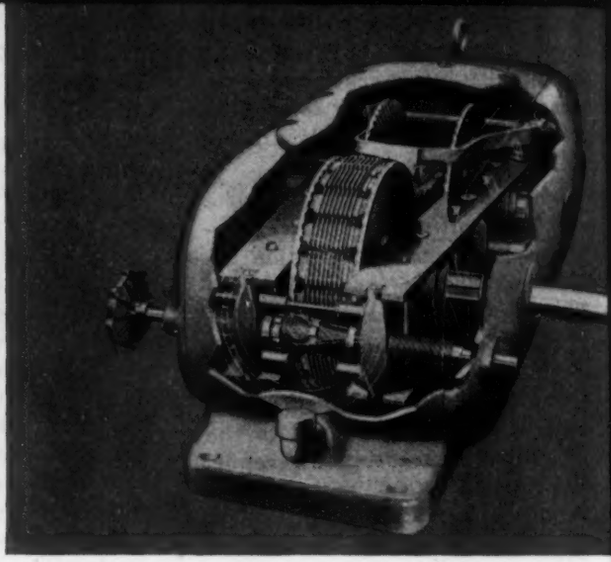




is Speed Reduction Your Problem





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Iron Age Introduces

(Continued from Page 23)

PAUL CHANDLER, assistant engineer of tests, Lukens Steel Co.

Paul Chandler has been appointed assistant engineer of tests, LUKENS STEEL CO., Coatesville, Pa. Mr. Chandler, who had been senior technical assistant in the metallurgical department, joined Lukens in 1947 as an industrial engineer. He had previously been employed in a similar capacity at the Homestead Works of Carnegie-Illinois Steel Corp.

John D. Ingram has rejoined the HORSBURGH & SCOTT CO., Cleveland, as sales engineer covering the Cleveland and northern Ohio district. He had previously been associated with the company from 1925 to 1941.

A. A. Gustafson has been appointed factory representative in Minnesota and in the counties of Eau Claire and Chippewa, in Wisconsin, for SCULLY-JONES & CO., Chicago.

A. P. Monroe, Jr., has been appointed manager of the new Pacific district office of the AMERICAN TYPE FOUNDERS SALES CORP., Elizabeth, N. J., handling sales of web-fed printing presses.

Leo J. Pantas has been appointed works manager of the specialties division plant of the YALE & TOWNE MFG. CO. in Salem, Va. Mr. Pantas, who prior to his new appointment,

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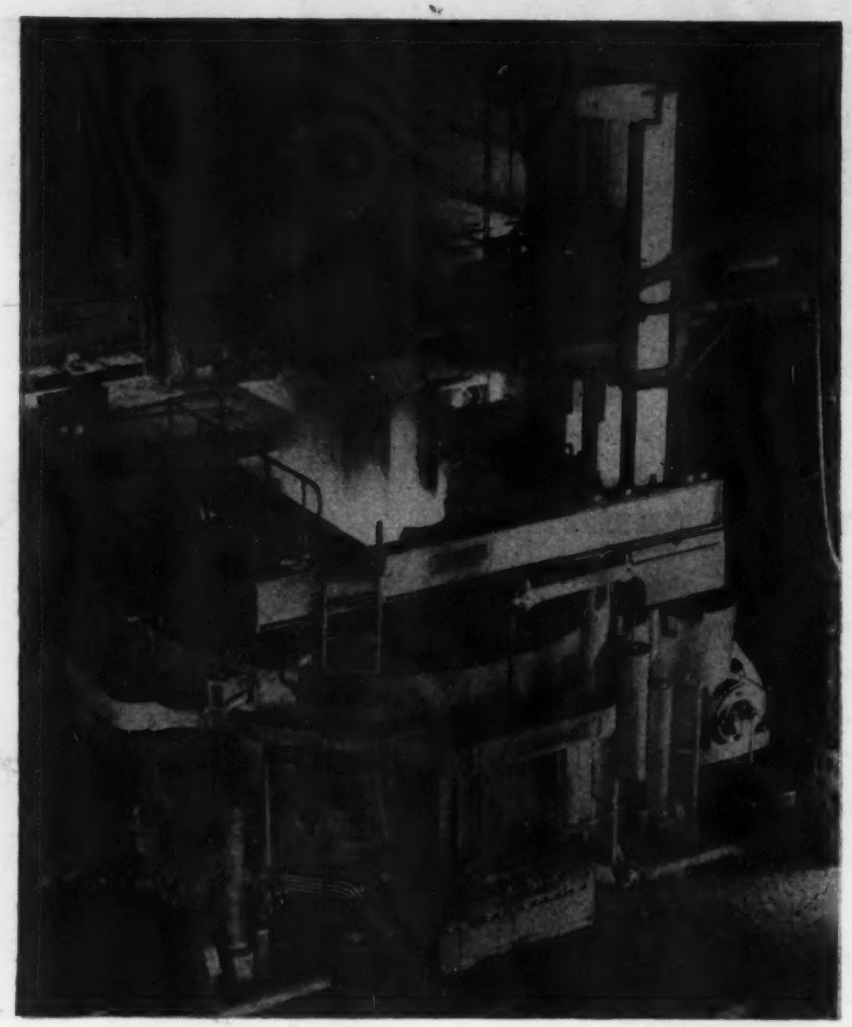

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IRON AGE INTRODUCES

Continued

served for 3 years as manager of the company's Buffalo plant, succeeds Mark A. Miller, who resigned as general manager in Salem, and becomes sales representative of the Stamford division in Virginia, West Virginia and Kentucky. Mr. Pantas joined Yale & Towne in 1929.

F. S. CORNELL, manager, Water Heater Div., A. O. Smith Co., whose appointment was announced in the July 28 issue of The Iron Age.

Newton D. Baker, III, secretary of Cleveland Graphite Bronze Co., has been appointed executive vice-president of HARRIS PRODUCTS CO., Milan, Ohio, and Cleveland, a subsidiary.

Douglas Jones has been appointed manager of the Salt Lake City district office of CHAIN BELT CO., Milwaukee, operating as the Douglas Jones Co.

A. T. Carrow has been appointed midwest sales division manager in Omaha for CRIBBEN & SEXTON CO., Chicago, succeeding **J. G. Schellenberg,** who has been transferred to the control division as central division sales manager, with headquarters in Chicago.

John S. Seltzer, who has recently served as manager of customer service and production control, JACK & HEINTZ PRECISION INDUSTRIES, INC., has been named manager of purchases and production control.

Lloyd C. Shackelford has been appointed wire and cable specialist for the construction materials department of GENERAL ELECTRIC CO., Bridgeport. He has his headquarters

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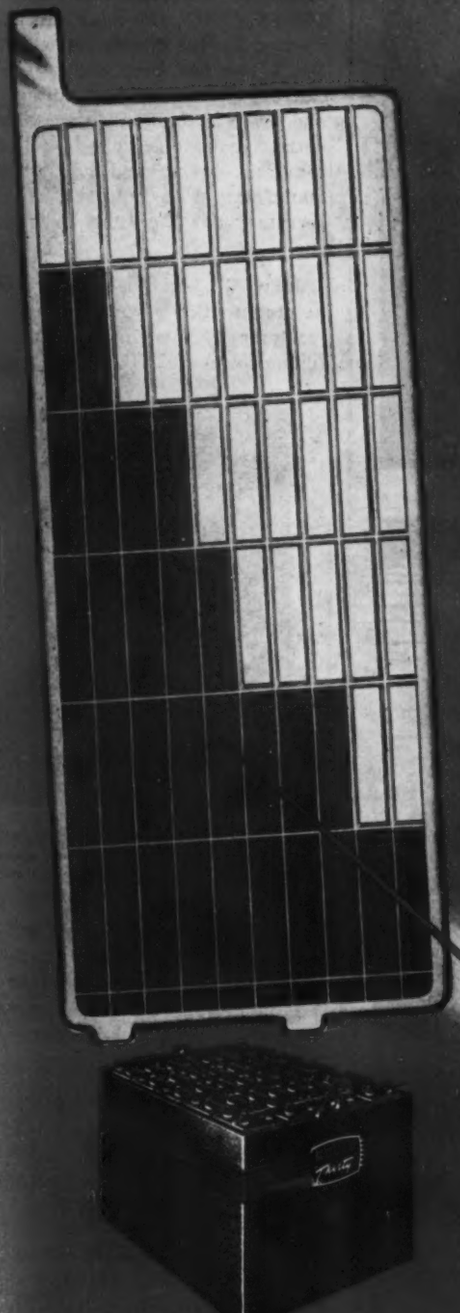

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IRON AGE INTRODUCES

Continued

in Seattle. Mr. Shackelford joined G.E. in 1941. **Harold W. Parrott** has been appointed operating manager of the new southeastern district warehouse of the department, with headquarters in Charlotte, N. C. Mr. Parrott has been associated with General Electric since 1930.

Otto J. Leone has been appointed manager of industrial sales for TRION, INC., McKees Rocks, Pa. Previous to his connection with Trion, Mr. Leone had been engaged in special engineering and consultant work and prior to that had been associated with Carnegie-Illinois Steel Corp., the Bristol Co., and had served as manufacturer's representative and secretary for the John D. Hiles Co., Inc.

John M. Van Vleet has been appointed to the newly-created post of vice-president in charge of manufacturing for the LINE MATERIAL CO.,

JOHN M. VAN FLEET, vice-president in charge of manufacturing, Line Material Co.

Milwaukee. Mr. Van Vleet had previously been associated with the Kyle Co. until its merger with Line Material in 1947, when he was named divisional vice-president in charge of the Kyle Co. Div.

C. R. Terry of Terry Machinery Co., Cleveland, has been appointed to represent FERRACUTE MACHINE CO., Bridgeton, N. J., in northeastern Ohio, including the Cleveland area.

M. D. Baughman, Jr., has been appointed assistant chief engineer, WEAN ENGINEERING CO., INC., Warren, Ohio. **A. A. Schmidt** has been named supervisor of construction and design engineering. **W. O. Jones** has been appointed chief design engineer.

C. D. **Shickley** has been made chief draftsman. **W. P. Tolbert** has been appointed chief draftsman, construction; **J. A. Weaver**, purchasing agent, and **A. P. Huntley**, assistant purchasing agent and traffic manager.

Falih N. Darmara has been appointed director of metallurgy and research for the UTICA DROP FORGE & TOOL CORP., Utica, N. Y. Mr. Darmara had previously served as research metallurgist for the Jet Propulsion Research Laboratory, National Advisory Committee for Aeronautics, and had also been associated with the research laboratory of the U. S. Steel Corp.

FALIH N. DARMARA, director of metallurgy and research, Utica Drop Forge & Tool Corp.

Andrew H. Gerhardt has resigned as chief engineer of the THOR CORP., Chicago. Mr. Gerhardt joined Thor in 1922 as a draftsman and has been chief engineer since 1937.

Watson S. Hall has been appointed to the Toronto sales office of AMERICAN WHEELABRATOR & EQUIPMENT CORP., Mishawaka, Ind. For the past 3 years, Mr. Hall has been a member of the service engineering staff of this organization. Before joining American Wheelabrator, Mr. Hall had been associated with Consolidated Mining & Smelting Works, in North Ontario and Nova Scotia, and with the Sullivan Mines in British Columbia.

Frank J. McLaughlin has resigned as executive assistant to the general manager of the PONTIAC MOTOR DIV., General Motors Corp., Pontiac, Mich. Mr. McLaughlin, who has spent nearly 40 years in the automotive pur-

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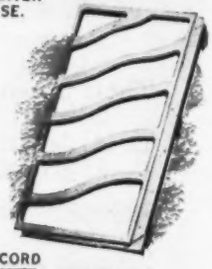

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IRON AGE INTRODUCES
Continued

chasing field, has bought the Jim Grier Pontiac Co. in Detroit, and now operates as the Frank McLaughlin Pontiac Co. **Martin F. Rummel** has been named to succeed Mr. McLaughlin as executive assistant to Pontiac's general manager.

George R. Kinney has been appointed sales manager of the V & O PRESS CO., Hudson, N. Y.

J. J. Dobbs has been appointed administrative assistant to the general sales manager of the OLDSMOBILE DIV., General Motors Corp., succeeding **L. L. Johnson**, who has been appointed Oldsmobile zone manager in Philadelphia. **Harry R. Ekblade**, who has been connected with Oldsmobile's field service operations since 1935, has been appointed general service manager, succeeding Mr. Dobbs in that position.

OBITUARY

Frederick K. Vial, 85, director and formerly president, Griffin Wheel Co., Chicago, died July 27.

Edward J. Burnell, 61, vice-president and general sales manager and a director, Link-Belt Co., Chicago, died July 22.

Lewis A. McKee, 64, president, San Toy Mining Co., died in Pittsburgh, July 31.

Dr. Archie G. Worthing, 68, professor of physics, University of Pittsburgh, died July 30.

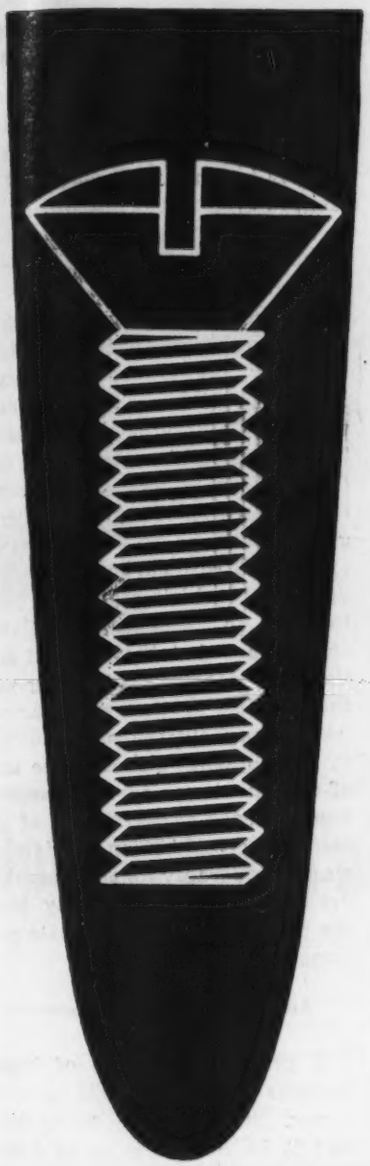
Frederick C. Bahr, vice-president of Chrysler Motor Parts Corp., Detroit, died July 25.

Edward Newcomb, 76, engineer and inventor, formerly technical adviser for the Studebaker Corp., South Bend, Ind., died July 25.

W. S. Hanford, 69, San Francisco representative for the Worth Steel Co., Claymont, Del., died July 26.

William M. Metzler, 89, consulting superintendent of mechanical goods division, Goodyear Tire & Rubber Co., Akron, and dean of the Akron rubber industry, died July 23.

(Resume Your Reading on Page 26)



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It only takes a moment to discover that the most carefully designed and engineered assembly is weakened by a faulty or ill-suited fastening. But it takes many years of experience to develop the know-how that assures dependable quality—right application every time. Blake & Johnson has been solving fastening problems—making trouble-free fastenings for 100 years. That's why you can always count on Blake & Johnson fastenings to save you trouble, spoilage and delays.

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There are many uses for Multigrip—from small step plates on machinery to coverings for entire factory floors. Get further information about Multigrip from your nearest steel warehouse or write to us direct.
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Homogenous Carburizing

(Continued from page 87)

fuse evenly throughout, but the important point is that the extension of heating times beyond the minimum requirements will cause no further increase in final carbon content. The importance of eliminating the time element will be appreciated when one considers the desirability or the absolute necessity for homogeneous carburization of any particular part which has a varying cross-section. The successful treatment of different cross-sections is illustrated in fig. 6, which shows photomicrographs of three different portions of an SAE 1010 carbon steel piece varying in thickness from 0.010 to 0.090 in. Emphasis is placed on the fact that the thinnest section, the intermediate section and the heaviest section were carburized throughout the same 0.45 pct C, and no more, although the time of treatment was set for complete homogeneous carburization of the heaviest cross-section. This time was considerably longer than that necessary to satisfactorily treat the thin and the intermediate portions of the sample.

Applications of Homogenous Carburizing

A practical example of homogeneous carburizing will be of interest. Steel cups ¼ in. in diam and ¾ in. long were to be drawn from a stel disk 0.020 in. thick to a final cross-section of side walls and bottom of cup varying from 0.007 in. at the top to the original thickness of 0.020 in. at the bottom. The projected use for these cups required quenching the steel at a 0.50 pct C level. Surface oxidation or even partial surface decarburization after heat treatment could not be tolerated. The severity of the forming operation did not permit the economical use of a 0.50 pct C steel at this stage of the process.

Homogeneous carburizing supplied a proper solution to this problem. Steel of 0.15 pct C and with suitable manganese content was easily drawn into cups of the desired dimensions. A heat treatment of approximately 1½ hr at 1600°F, in a properly balanced at-

Courtesy Hyscore Arms Co., Brooklyn, N.Y.

Does This Tubing Idea Hit Your Target?

Aiming for an inventory reduction . . . lower production costs . . . or a sales edge on competition? Try sighting along the tubing idea in this target pistol.

This airgun is accurate within a ¾" bulls-eye on a 20' test range. It is powered by a hardened piston which, in only a 2" stroke, develops enough energy to slam a .22 cal. pellet through a ⅜" pine board.

Note the ingenious design . . . how the entire gun barrel, from piston chamber to gunsight, is cold-swaged from a single piece of seamless steel tubing—a considerable saving over composite construction. The barrel tubing is supplied by Frasse with a special I. D. cylinder finish, to close tolerances—and provides a leakless air-seal for the piston—*without the expense of further machining.* Completion of the barrel requires 15 separate fabricating operations, from swaging and broaching through milling and threading—an exacting application made possible only with quality tubing and engineering teamwork.

Frasse, a leading distributor of steel tubing, stocks a wide range of immediately available carbon, alloy and stainless analyses to work from. But equally available, and equally useful, are Frasse engineering facilities to help you use tubing to your economical advantage. *Call Peter A. FRASSE and Co., Inc., 17 Grand St., New York 13, N. Y. (Walker 5-2200) • 3911 Wissahickon Ave., Philadelphia 29, Pa. (Baldwin 9-9900) • 50 Exchange St., Buffalo 3, N. Y. (Washington 2000) • Jersey City • Syracuse • Hartford • Rochester • Baltimore*

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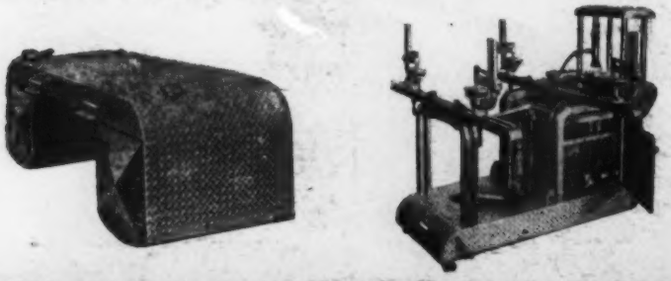

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mosphere, resulted in through carburization of all portions of the cups to within 0.03 pct C of the desired 0.50 pct value. Direct quenching in oil gave an entirely suitable hardened product. The variations in metal thickness with no corresponding variations in carbon content of the cups further substantiates the soundness of the process.

The very nature of the process makes it apparent that the thickness of the betal being treated must determine the practicability of homogeneous carburizing. The only limiting factor in determining the thickness of material to be homogeneously carburized is the time available for the treatment. Steel parts with a maximum thickness of 1/16 in. may be raised to any desired carbon content throughout in approximately 7 hr at a temperature of 1600° to 1700°F. Parts of heavier gage will require longer times and the suitability of the process must then be determined by weighing advantages to be gained by the use of low carbon steels for forming, as opposed to the disadvantage of long heat-treating cycles. In some instances, it has been found that steel up to ⅛ in. can be economically treated by the homogeneous carburizing process.

During many discussions of the process, particularly as related to the treatment of steel parts 1/16 in. in cross-section or heavier, the question most frequently raised pertains to the possibility of shortening time of treatment by allowing some gradiation of carbon content from surface to center. Apparently there are a number of applications where satisfactory physical properties can be obtained with, for example, 0.50 pct C at the surface and 0.30 to 0.40 pct C at the center of the piece. There is no question but that such a modification of the homogeneous carburizing process would materially shorten the heat treating time and increase its field of applications to sections considerably heavier than ⅛ in.

Experimental work along these lines is being carried on and some

Here is Plain PROOF...

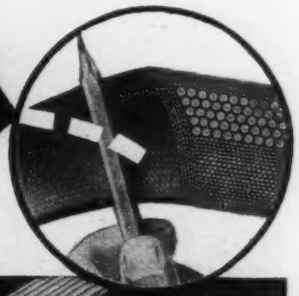
You can actually *feel* the sides of a belt *change shape* as the belt bends.

That the

CONCAVE SIDE

(U. S. Patent No. 1813698)

SAVES Transmission DOLLARS



When a *straight-sided* V-Belt bends around a pulley, three things are bound to happen.

(1) The top of the belt, being under tension, *narrows.* (2) The body of the belt, under compression, *widens.* (3) The sides of the belt *bulge out.*

These *shape changes* are inevitable. They are shown in figures 1 and 1-A, below.

Straight-Sided V-Belt.

How Straight-Sided V-Belt Bulges in Sheave-Groove.

Because this bulging belt does not fit the sheave groove, two facts become clear. (1) The belt will get excessive wear where it bulges—*shorter life!* (2) The whole side of the belt cannot *uniformly* grip the pulley—*a loss in drive efficiency.*

How different the V-Belt with the precisely engineered *concave* side (U.S. Patent No. 1813698)—the Gates Vulco Rope. As this belt bends it assumes a shape that *exactly* fits the sheave groove. (Figures 2 and 2-A, below.)

Gates Vulco Rope with Concave Side.

No Side Bulge. Precise Fit in Sheave-Groove.

Two savings result. (1) The Gates Vulco Rope wears evenly—*longer life!* It's entire side-wall grips the pulley—no slip—*full delivery of power!*

The Mark of SPECIALIZED Research

The Concave Side is MORE IMPORTANT NOW Than Ever Before

Because the sides of a V-Belt are what actually drive the pulley it is clear that any increased load on the belt means a heavier load that must be transmitted to the pulley directly through the belt's sidewalls.

Now that Gates *SPECIALIZED* Research has made available to you SUPER Vulco Ropes—carrying fully 40% higher horsepower ratings—the life-prolonging Concave Side is naturally more important in conserving belt life today than ever before.

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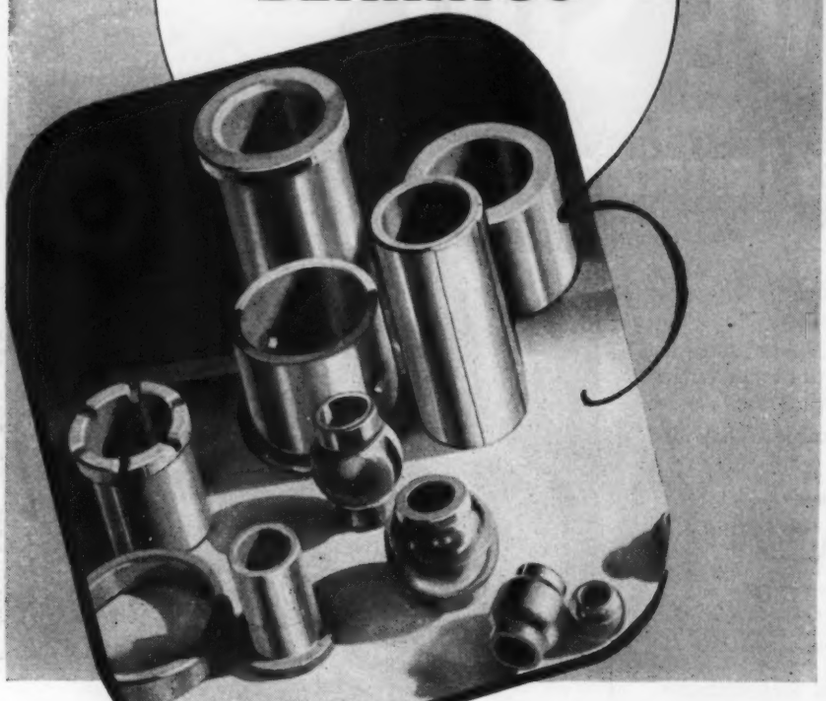

NEW USES for these porous, oil-impregnated bearings are being discovered every month. They answer the long-felt need in applications where it is difficult or impossible to supply adequate lubrication. They may even be sealed in place. Johnson Ledaloyl Bearings can be used, too, for their low cost in many applications where heavy duty service is not a factor. Being molded under high pressure from powdered metal, they are much lower in cost than machined bearings, particularly in odd-shaped, flanged and self-aligning designs, and in large quantities of a size. You, too, may find practical uses for them and benefit from substantial savings.

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NEW

PRODUCTION IDEAS

Continued from p. 30

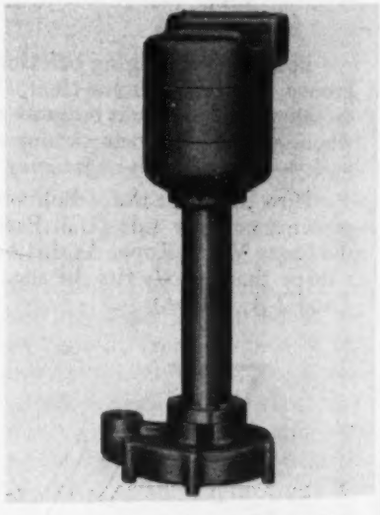
pilot valves are available in cam, lever, push-button and foot operated types. *Hanna Engineering Works. For more information, check No. 23 on the attached postcard.*

Tube Cleaning Vats

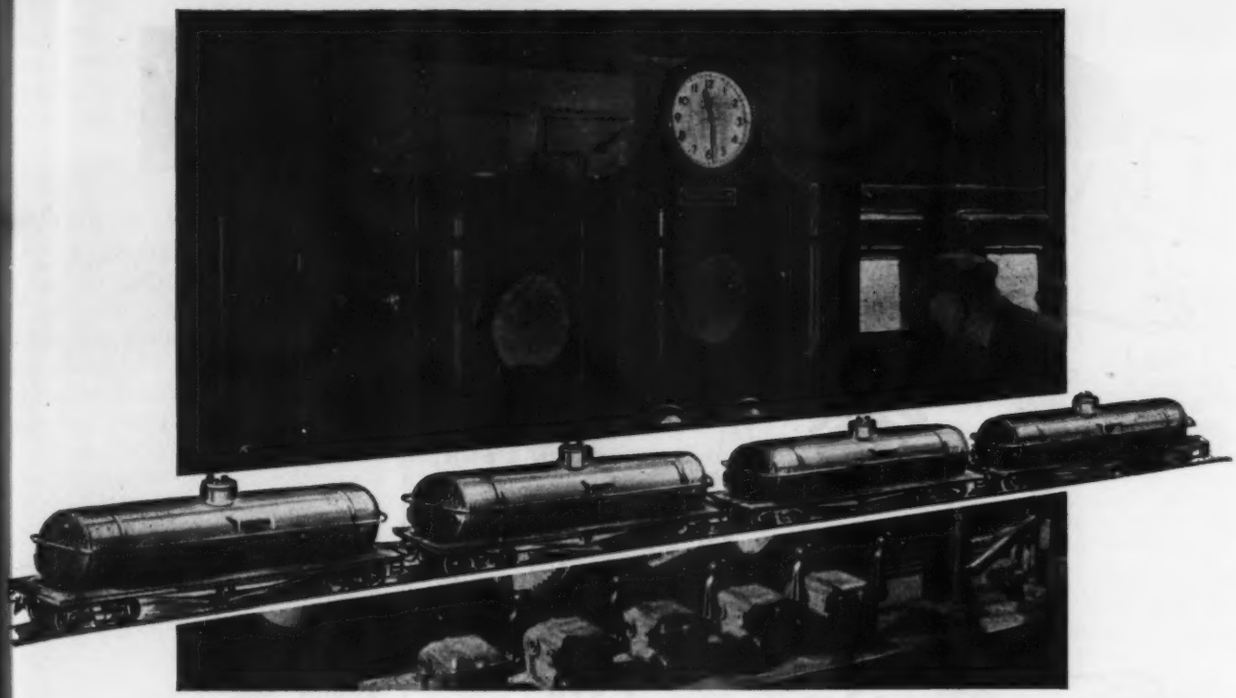
Cleaning long lengths of electric welded tubing is simplified by using large wood vats. Up to 22-in. tubing is lowered into the vat, on an angle, by a crane. Air or steam is forced through the tubing to effect proper cleaning. The vat can also be used for pickling operations. It measures 26 x 4½ ft x 27 in. *Wendnagel & Co., Inc. For more information, check No. 24 on the attached postcard.*

Gusher Pump

A new motor driven gusher pump embodies such features as a large multiple upper inlet cast into the



upper section of the impeller housing, an independent flanged vertical tubular housing between the motor and the impeller housing, and ample clearance between the motor and the straight vertical discharge pipe. The standard pump is made of cast iron, but can be made of stainless steel, bronze, aluminum, lead antimony alloy, etc. The shaft



4 TANKERS OF OIL FREE—EACH MONTH TO THIS USER OF L&N O-H CONTROLS

About four years ago one of the big steel mills installed L&N automatic controls for roof temperature and for furnace pressure on their 175-ton open-hearth furnaces. The furnaces had operated on Manual Control—and were good producers, making 8500 tons of steel per month at satisfactory cost figures. But the company engineers decided that this new instrumentation would save more than enough fuel to justify the improvement.

Just how right these engineers were is shown by the fact that the instruments save four to five gallons of oil per ton of steel—which adds up to four cars per month—or enough oil to pay for the instrumentation every four and one half months!

Furnaces Always Well Handled

This showing is all the more significant because the furnaces have always been handled with skill—before and after automatic control was adopted. The First Helpers in this plant are steel-making experts who would be more than welcome in any mill. Backing them up is an outstanding metallurgical department, and the Company (sorry, can't name it here) is one of the biggest, with a long-standing name for fine steel. In other words, these instruments were not facing a straw man—they had to beat the very best that expert personnel and fine furnaces could do under Manual Control. And the instruments succeeded.

Other Costs Go Down

Furnace "campaigns" are longer, because the roofs (usually the first structural part to go when a furnace needs rebuilding) are protected against overheating. There's a slight but noticeable improvement in the man-hours-per-ton ratio. Instruments operate continuously and unfailingly, with only scheduled maintenance at customary intervals.

Panels By L&N Cut Installation Cost

Control panels were designed and built by L&N; shipped with all connections in place for every item on the panel. Each panel is in effect one huge instrument for making more steel at lower cost.

Details of these and other L&N instruments for open-hearth control will be sent on request. Address Leeds & Northrup Co., 4956 Stenton Ave., Philadelphia 44, Pa.

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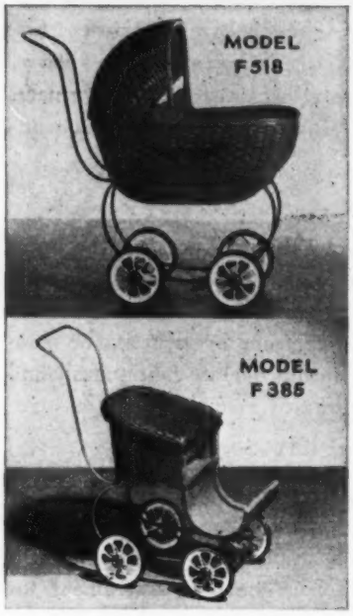

*South Bend Toy Mfg. Co.
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The Keystone extra-brite basic wire used in the frame, hood, axles and handle is easily formed, spot welded and provides proper base for enamel.

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NEW

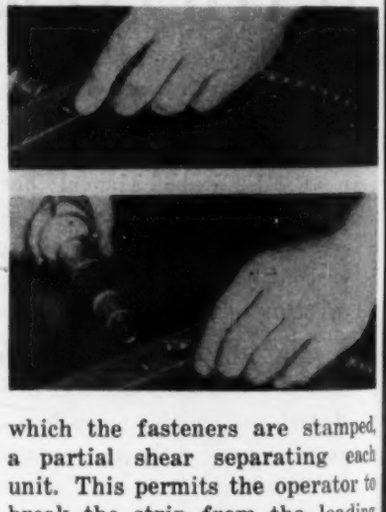
PRODUCTION IDEAS

Continued

is available in standard cold rolled or stainless steel. The totally enclosed drip proof driving motor has a large conduit box and precision prelubricated for life, ball bearings. Capacities are 25, 30, and 40 gpm at 15, 13, and 10 ft head, respectively, with 1¼ in. discharge pipe, utilizing ¼ hp, 1725 rpm motor. *Ruthman Machinery Co. For more information, check No. 25 on the attached postcard.*

Speed Nut Strips

Flat-type speed nuts are being produced in continuous strips. Called the Tandem-type Speed Nut, the new product consists of a strip of pre-tempered spring steel into



which the fasteners are stamped, a partial shear separating each unit. This permits the operator to break the strip from the leading speed nut with a clean separation as it is tightened. Available for 10-24 screws, Tandem Speed Nuts are produced in strips or coils. *Tinnerman Products Inc. For more information, check No. 26 on the attached postcard.*

Portable Pallet Crane

A new portable pallet crane, combining flexibility and bulky weight handling capacity, has a 16x24 in. heavy steel plate pallet, capable of handling objects up to 500 lb. It lowers to floor level, elevates to a

maximum height of 5½ ft, and can be stopped at any intermediate height. Hand hydraulic lift is provided, but it also can be supplied

with a motorized hydraulic lift. A hand brake holds the crane in any desired position. *Grand Specialties Co. For more information, check No. 27 on the attached postcard.*

Stainless Piston Rings

A new series of Non-Breakable piston rings are made of stainless steel, are free from distortion, and said to reduce friction and wear by providing a dissimilar metal for the rubbing surfaces. They increase compression efficiency by a near-constant expansion factor that permits closer tolerances between ring and cylinder wall. Stainless steel rings are formed from open-end metal to true circle proportions and heat-treated in that shape. All rings are ground on the OD and are lapped on the sides to provide perfect seating. Two rings can be employed in the same ring grooves. The stainless steel rings are said to be especially suitable for high temperature applications. *Steel or Bronze Piston Ring Corp. For more information, check No. 28 on the attached postcard.*

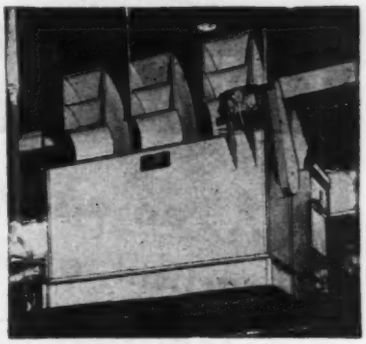
End Mills

Less breakage, more cuts per grind, consistent accuracy and 50 pct increase in feed are advantages claimed for redesigned end mills. New clearance and accurate ma-

New HIGH PRESSURE STEAM Fan Heater

Gives Savings You Never Had Before

The first heater to make High Pressure Steam really trouble-free and practical in plant heating. Every engineer should understand its original method; write for Niagara Bulletin and performance data.



HOW IT OPERATES: — A dual coil system makes use of all heat, both sensible and latent. High pressure steam enters the upper coil, shown on the diagram below. Its condensate drains into a trap. Then this high pressure condensate is released into the header of the lower coil. It instantly flashes into steam at vapor pressure.

Any high pressure condensate that remains liquid is carried to the vapor condensate return header by a drain tube that also gives off its heat into the air stream.

The vapor condenses in the lower coil. Its condensate is kept at a high level in the return leg by a wier in the return header so that all its heat is made useful and it is sub-cooled by contact with the coldest air entering the heater. Vacuum condensate return to boiler is vapor free.

HOW IT SAVES IN COST: — Piping is much simpler and less costly than in low pressure systems. Much secondary piping, traps and big valves are not needed. Pipe sizes are smaller.

HOW IT SAVES IN OPERATION: — Waste is prevented. Every BTU goes where you want it. No dump traps or hot wells waste live steam.

HOW IT SAVES IN UPKEEP: — Condensate flow is even, vapor free, easily handled. No sudden surges of condensate in starting. No hammering, no hard wear and tear on system. Properly engineered for the job, final air temperatures are not excessive; heat easily directed where needed; no flashing of low pressure condensate. Heaters are self-draining on shut-down. Heaters are strongly built; all coils including the condensate drain tubes are hairpin bend, stress relieving. Use thru four heating seasons has proven these advantages in large scale plant heating.

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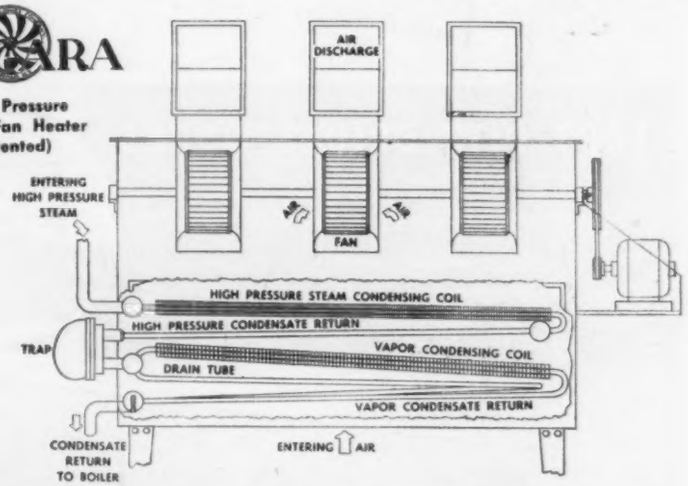

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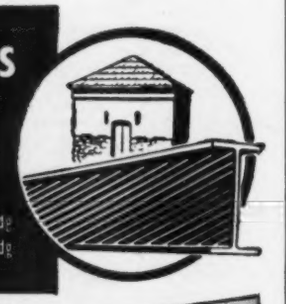
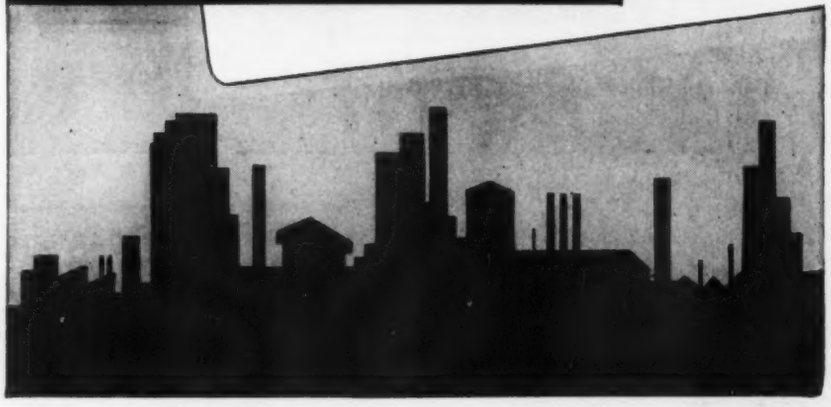




NEW

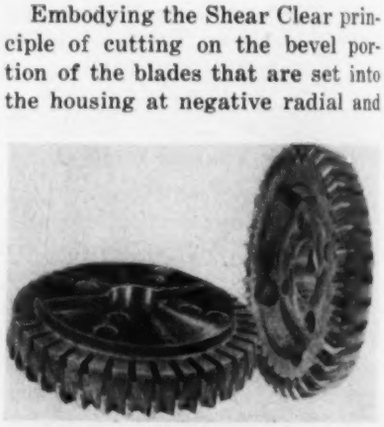
PRODUCTION IDEAS

Continued

chine polished flutes result in closer control of size. There are no pockets, and chips are free to move, reducing wear on the cutting edge. There are no sharp corners or points where localization of stresses might occur. New-style clearance supports the cutting edge and assures against flaking or chipping out. The new shape also is said to give maximum cutting qualities at increased rates of feed. *Cleveland Twist Drill Co. For more information, check No. 29 on the attached postcard.*

Face Mill

Embodying the Shear Clear principle of cutting on the bevel portion of the blades that are set into the housing at negative radial and



positive axial rake angles, a new face milling cutter features carbide tipped blades for high feed rates in milling cast iron. This new series has fine blade spacing—38 blades in a 10-in. cutter—and uses new cutting angles. The cutter is suitable for feed rates up to 75 ipm. *Ingersoll Milling Machine Co. For more information, check No. 44 on the attached postcard.*

Scrap Chopper

Producing uniformly cut 1½-in. scrap pieces especially suited for foundry use is possible with a new type automatic scrap chopper, rated at 72 pieces per min. By such sizing practice, the exact amount of scrap that should be

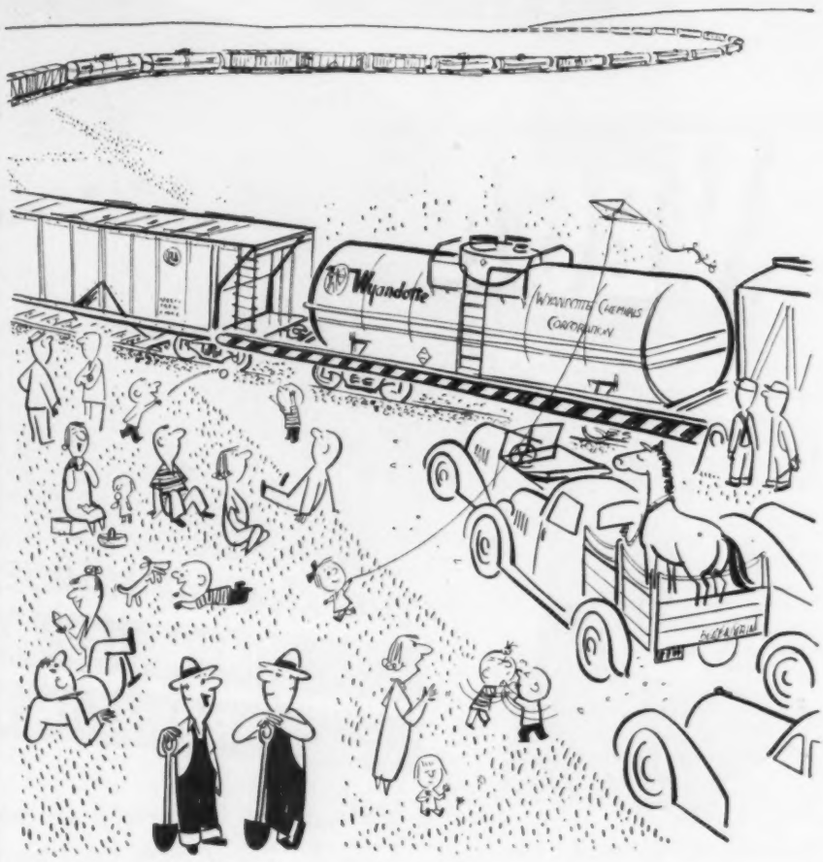
added to a heat can be easily weighed out and shoveled into the cupola. The 1½-in. scrap lays solid when melting. The compact unit, occupying only 5½ x 2½ ft of floor space, has a removable tool steel knife that rotates at 72 rpm. This blade is designed with a 1½ in. offset that controls the length of pieces cut. A 1 ton hopper-type floor

truck rolls under the machine to receive the scrap as it is cut. It can be picked up with a crane, and contents dumped. Tonnage per truck hopper load remains fairly constant, as lightweight metals pack solidly. Any metal scrap up to ¼-in. thick can be handled by the machine. *Wenthe-Davidson Engineering Co. For more information, check No. 45 on the attached postcard.*

Abrasive Wheels

Fibrex Red Wheels, a new type of synthetic resin bonded grinding wheel of extra strength and durability are built up of laminated sheets of cotton fiber filled with abrasive grain. The field of application for them is between heavy grinding and light sanding, and for certain types of abrasive cutting-off, deburring and finishing operations. They are offered in 7- and 9-in. depressed center type for use on portable disk sanders and right angle type portable grinders; and in straight wheels 6, 8, 10 and 12 in. diam x ⅛ in. thick for cutting off and general purpose use. The wheels are slightly flexible, allowing a certain amount of side pressure. *Simonds Abrasive Co. For more information, check No. 46 on the attached postcard.*

(Resume Your Reading on Page 32)



"They've been waitin' here for seven hours"

You'll never have to wait this long for a moving train at a railroad crossing, but that's what *would* happen if the annual production of Wyandotte Chemicals Corporation were put into a single freight train. It would take more than 29,000 tank, box, dry ice and hopper cars to carry the 1,250,000-ton load. Moving at 30 mph., the 222-mile-long train would pass a given spot in about seven hours.

Wyandotte Chemicals Corporation, with its own sources of raw materials, is the world's largest manufacturer of specialized cleaning compounds for business and industry.

Wyandotte makes the *complete* line of balanced metal cleaners, including products for any soak, electrolytic, spray or tumble operation, as well as degreasing, burnishing and burring compounds. No matter what your cleaning needs may be, it will pay you to get in touch with your nearest Wyandotte Representative. He's always at your service.

Wyandotte
REG. U. S. PAT. OFF.
WYANDOTTE CHEMICALS CORPORATION
Wyandotte, Michigan • Service Representatives in 88 Cities

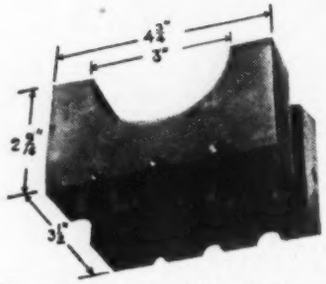
UNIVERSITY OF MICHIGAN LIBRARIES

(Inside Rockwell "C" Hardness of Section Cut Midway on 8" Round x 15" Long VEGA. Air Cooled at 1550° F. 1 Hour at Heat)

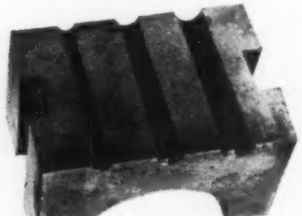
THE *New* AIR-HARDENING TOOL STEEL . . .

. . . SIMPLIFIES HEAT TREATMENT!

. . . HARDENS IN HEAVY SECTIONS!



These chucking and forming dies, first made from an oil-hardening tool steel, "opened-up" .030"/.035" across the 3" diameter. To get minimum distortion in heat treatment, the tool maker changed to VEGA.



As a result, over-all expansion was held to .0004"/.0005"—with no evidence of warpage. And in the tool maker's own words, "VEGA machined in every respect as well as the oil-hardening tool steel previously used."

Hardening uniformly in very heavy sections from only 1550°F., VEGA cuts heat treating costs—makes special high temperature furnaces unnecessary. Its lower hardening temperature often enables you to eliminate expensive pack hardening to avoid excessive scaling. Moreover, VEGA gives you minimum distortion and size change, good machinability, resistance to decarb, freedom from excessive scaling and excellent toughness with good hardness.

Put VEGA's many advantages to work today on jobs such as blanking, piercing, trimming and forming light and heavy-gauge sheet metal. And for more information on its easy heat treatment and use, ask for the new VEGA folder. A note on your company letterhead, indicating your title, is all that's required.

THE CARPENTER STEEL COMPANY, 121 W. BERN STREET, READING, PA.

***NOW*—FOR MORE INFORMATION ON . . .**

Carpenter AIR-HARDENING TOOL STEELS 100% ACID-DISC-INSPECTED

. . . CALL YOUR CARPENTER WAREHOUSE OR DISTRIBUTOR

GUARANTEED CLEAN DIOK SOUND UNIFORM

SEE YOUR CLASSIFIED TELEPHONE DIRECTORY

Baltimore • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Dayton • Detroit • Hartford • Houston • Indianapolis • Los Angeles • New York • Philadelphia • Portland, Ore. • Providence • St. Louis • San Francisco • Seattle • Worcester, Mass. • In Canada: Toronto and Montreal

MARKET

Briefs and Bulletins

barge headaches—Differences in shipping charges by barge out of Pittsburgh are plaguing steel makers there. One company charges about half as much for switching from mill to barge as do other producers. Loading charges from cars to barge have not been charged by any Pittsburgh producer since May. The difference in switching charges shows up as a difference in delivered price to customers and also poses the delicate question of uniform mill net, apparently important under f.o.b. mill selling. In the effort to clarify things one large corporation has delegated a special market research committee to fully study the whole situation.

argentine pig—Argentina recently sent three tons of pig iron to Timken Roller Bearing Co. for tests to determine whether high quality steel may be produced from it. Two heats were run in a one-ton electric furnace. Both tests were declared satisfactory. Argentina's blast furnace uses charcoal and produces high phosphorous pig iron. For steelmaking that country's openhearths melt imported scrap.

operating—Newport Steel Corp's new reversing strip mill is now in operation. This is the first unit in a modernization which began in March, 1948. Other improvements nearing completion are three electric furnaces with annual capacity of 300,000 ingot tons. G. Russell Feldmann, president, said the blast furnace at Martin's Ferry, Ohio, was recently closed because iron could be bought cheaper than it could be produced there.

new approach—Rev. Thomas F. Coakley, pastor of Sacred Heart Catholic Church, Pittsburgh, has a new approach to labor problems. He suggests that when a union calls its members out on strike that union leaders go off the payroll, too. Father Coakley's remarks from the pulpit were prompted by the two-months-old bricklayer strike which has halted work on a new $150,000 convent.

lower rails—Colorado Fuel and Iron Corp. is now quoting $3.200 per 100 lb for standard rails, 100 lb and heavier, No. 1 quality. This is the price charged by other producers. Former price was $3.30 per 100 lb. New price was effective Aug. 1.

record payroll—Total payroll of the steel industry in the first half of 1949 is estimated at $1,161,000,000. This is an increase of $107,000,000 over the first half of 1948, according to the American Iron and Steel Institute.

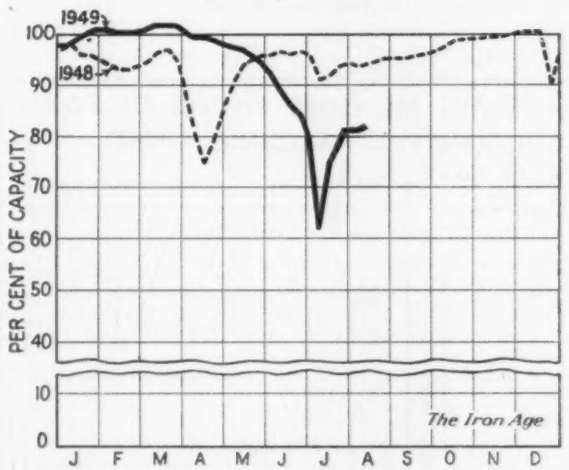
in a nutshell—Last week on the eve of B. F. Fairless' receipt of an honorary degree from Bryant College, he and Irving S. Olds chatted with newspaper men. They said: (1) U. S. Steel anticipates no steel production increase above the present level of 82 pct of capacity, (2) current production isn't justified by the rate of new orders, (3) hence the corporation is eating into its backlogs and (4) the 82 pct production capacity could very possibly go lower.

flash buying—Immediately prior to the recent steel crisis there was a small flurry of warehouse buying, sometimes by major auto companies for their suppliers. This has turned out to be a flash in the pan, however, according to informed sources. They now believe this experience is not likely to be repeated until the last minute before a steel strike is actually called.

tracers—Radioactive tracers are now being used to follow the flow of a boundary between two different types of crude oil. After one grade of oil has passed into the pipe a small amount of radioactive material is added before the second grade of oil enters the pipe. The radioisotope then serves as a means of telling where the boundary between the two crudes is located.

silvery iron—Pittsburgh Metallurgical Corp. now quotes 15.01 to 15.50 pct silicon blast furnace silvery iron at $73.50 per ton f.o.b. Niagara Falls.

Steel Operations



District Operating Rates—Per Cent of Capacity

Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	Ohio River	St. Louis	East	Aggregate
July 31	79.0*	89.0	59.5*	82.0	95.0	98.0	96.0	103.0	98.0	85.2	67.0	75.5	29.5	91.5
August 7	80.0	90.5	63.0	82.0	99.5	98.0	96.0	97.0	98.0	80.5	76.0	73.0	42.0	82.5

(* Revised)

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U. S. Report Details 1948 Machine Tool Shipments

Total of $277.5 million 14 pct. under '47 figure

Cleveland—Machine tools valued at $277.5 million were shipped during 1948, a decline of more than 14 pct from the preceding year, according to the Bureau of the Census, U. S. Dept. of Commerce. Other highlights of the report on machine tools, prepared by the Bureau's industry division follow:

Three major types of machine tools, lathes, grinding and polishing machines and milling machines accounted for 60 pct of the total value of machine tools shipped during 1948.

Lathes accounted for more than $81 million. Grinding and polishing machines accounted for $47 million and milling machines $35 million.

Shipments of boring machines totaled 1268 machines valued at $24.1 million, a decline from shipments of $27.5 million in 1946 and $25.8 million in 1947. More than a third of the total value of boring machines was accounted for by shipments of 282 vertical boring and turning mills, including vertical turret lathes.

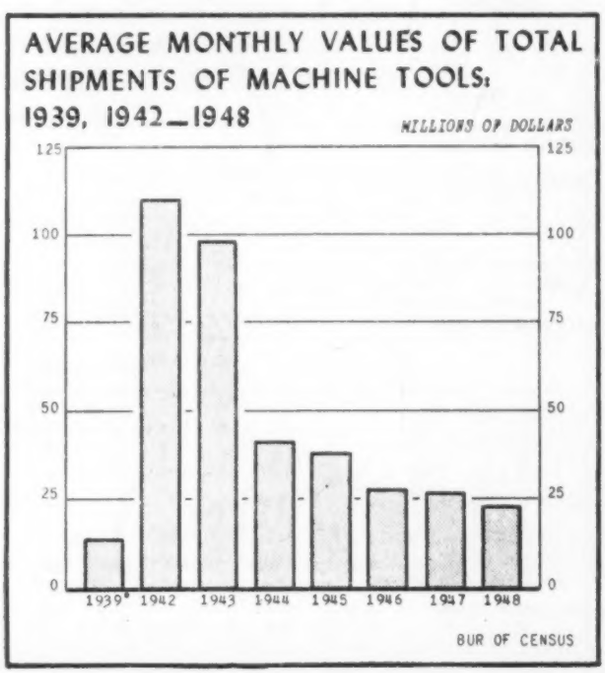
Shipments of horizontal boring, drilling and milling machines showed a sharp decrease from 1947, the report noted.

Drilling machines, including light industrial types, amounted to $32.8 million in 1948, a slight decrease from 1946 and 1947. More than half the total value of drilling machine shipments was accounted for by multiple spindle machines valued at $18.4 million.

Other Shipments Described

Gear cutting and finishing machines amounted to $16.4 million, representing a small decrease in both number and value from 1946 and 1947. Gear shapers, cutters and generators accounted for more than half the total value of shipments, but all types of gear cutting and finishing machines showed a decline in shipments between 1947 and 1948.

Grinding and polishing machines accounted for $47.3 million of 1948 machine tool shipments, a decrease of about 16 pct from 1947 shipments. However, in 1948 shipments of external cylindrical grinding machines were less than in 1946 and 1947, the number and value of roll grinders increased substantially. Bench grinders also showed increase in 1947 and 1948.



Lathe shipments amounted to $81.1 million in 1948. Engine lathes accounted for $35 million or more than 40 pct of the lathe total. This represents a four pct decrease from 1946 engine lathe shipments and a slight increase over 1947.

Milling machine shipments in 1948 amounted to nearly $35 million which was less than 1946 and 1947 totals. Principal types were bed and knee, which represented 60 pct of the total.

Companies located in the New England and East North Central states shipped over 80 pct of total 1948 machine tool shipments. Ohio was first with $95 million, one-third of the U. S. total, and the five East North Central States, Ohio, Indiana, Illinois, Michigan and Wisconsin accounted for more than 60 pct of the U. S. total.

Machine tools were produced in 23 states in 1948.

Construction Steel Awards

Fabricated steel awards this week included the following:

2100 Tons, Milwaukee, building for Nash Kelvinator Co. to Worden-Allen Co., Milwaukee.

650 Tons, Pineville, Ky., power unit No. 3 for Kentucky Utilities Corp. to American Bridge Co., Pittsburgh.

540 Tons, Ines, Ill., 12 garage storage buildings for the National Guard through Ashland Construction Co. to Hansell-Elcock Co., Chicago.

300 Tons, Mitchell, S. Dak., state highway bridge section FAGM-UG-18-10-N, to Iowa Iron & Steel Co., Cedar Rapids, Iowa.

215 Tons, Jefferson County, Wis., state highway bridge section F-005-53 to American Bridge Co., Pittsburgh.

205 Tons, Douglas County, Wis., state highway bridge section FN-FAGM-08-5-12 to American Bridge Co., Pittsburgh.

Fabricated steel inquiries this week included the following:

2500 Tons, Williamsport, Pa., bridge, Pennsylvania Dept. of Highways, due Sept. 9.

2380 Tons, Gloucester, Mass., steel bridge superstructure, Bethlehem Steel Co., Bethlehem, low bidder.

1900 Tons, Island Heights, N. J., additional tonnage bridge to Seaside Heights, New Jersey Dept. of Highways, due Aug. 11.

600 Tons, Jefferson, Wis., county courthouse reported back in May, has been temporarily abandoned because of high cost.

515 Tons, Groveland and Haverhill, Mass., reconstruction of bridge over Merrimac River on Main St.

500 Tons, Dauphin County, Pa., Pennsylvania Turnpike Section 22 B, due Aug. 24.

500 Tons, Cumberland County, Pa., Pennsylvania Turnpike Section 21 A-1, due Aug. 17.

180 Tons, Middlesex County, N. J., New Jersey Dept. of Highways, bridge, due Aug. 18.

Reinforcing bar awards this week included the following:

235 Tons, Quartzite, Ariz., construction on Ehrenberg-Wickenburg highway toward

Quartzite, through Yount Constructors, Inc., Azusa, Calif., to Bethlehem Pacific Coast Steel Corp.

200 Tons, Waterloo, Iowa, hospital building to Laclede Steel Co., St. Louis.

100 Tons, Chicago, apartment building 4029 Marine Drive, to J. T. Ryerson & Sons, Chicago.

100 Tons, Wauwatosa, Wis., auditorium and recreation house for the Milwaukee County Institute to Ceco Steel Products Co., Chicago.

100 Tons, Chicago, warehouse for Fairbanks Morse & Co., to Ceco Steel Products Co., Chicago.

100 Tons, Chicago, Queen of Saints Rectory, to Ceco Steel Products Co., Chicago.

100 Tons, Greenup, Ill., bridge to Laclede Steel Co., St. Louis.

Reinforcing bar inquiries this week included the following:

465 Tons, Chicago, housing relocation site No. 6.

340 Tons, Chicago, housing relocation site No. 2.

215 Tons, Gloucester, Mass, steel bridge superstructure, Bethlehem Steel Co., Bethlehem, low bidder.

195 Tons, San Francisco, San Joaquin pipe line No. 2, Public Utilities Commisson, San Francisco, Contract HH No. 216, bids to Aug. 23.

175 Tons, Lincoln, Ill., power plant.

135 Tons, Dyer, Ind., Mercy Hospital and Sanatorium addition.

100 Tons, Groveland and Haverhill, Mass., reconstruction of Groveland Bridge over Merrimac River on Main St.

Steel piling awards this week included the following:

1200 Tons, Schuylkill River, Pa., five temporary sheet piling cellular dams at Birdsboro, Douglassville, Valley Forge, Phoenixville, and Pottstown, Pennsylvania Dept. of Forests & Water, through Conduit & Foundation Co., Philadelphia, to Bethlehem Steel Co., Bethlehem.

1035 Tons, Indiana Harbor, dock wall for Youngstown Sheet & Tube Co., through Great Lakes Dredge & Dock Co., South Chicago, to Carnegie Illinois Steel Corp., Pittsburgh.

June Shipments of Steel Products Including Alloy and Stainless

By American Iron and Steel Institute

Steel Products	Number of companies	Items	Current Month: Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or For Resale) (Net Tons)	Current Month: Per cent of Total Shipments	Current Month: Shipments to Members of the Industry for Conversion into Further Finished Products or For Resale (Net Tons)	To Date This Year: Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or For Resale) (Net Tons)	To Date This Year: Per cent of Total Shipments	To Date This Year: Shipments to Members of the Industry for Conversion into Further Finished Products or For Resale (Net Tons)
Ingots, blooms, slabs, billets, tube rounds, sheet and tin bars, etc.	47	1	139,148	2.7	146,267	1,486,524	4.4	1,375,977
Skelp	6	2	16,396	0.3	32,343	55,154	0.2	240,433
Wire rods	21	3	46,334	0.9	13,047	306,282	0.9	132,352
Structural shapes (heavy)	11	4	327,230	6.3	3,758	2,190,856	6.5	17,121
Steel piling	3	5	37,404	0.7	32	181,336	0.5	1,357
Plates	28	6	516,709	10.0	14,332	3,624,346	10.8	127,222
Rails—Standard (over 60 lbs.)	4	7	203,028	3.9	1,625	1,090,248	3.3	6,299
Rails—All other	5	8	7,650	0.2	25	79,298	0.2	1,203
Joint bars	7	9	10,844	0.2	2,508	68,057	0.2	21,154
Tie plates	6	10	37,442	0.7	-	245,792	0.7	41
Track spikes	8	11	11,053	0.2	-	66,126	0.2	35
Wheels (rolled or forged)	5	12	30,090	0.6	101	179,437	0.5	598
Axles	5	13	15,050	0.3	12	114,064	0.4	29
Hot rolled bars (including light shapes)	39	14	564,172	10.9	58,060	3,956,088	11.8	416,221
Hot rolled bars—Reinforcing	24	15	141,292	2.7	23	834,101	2.5	2,264
Cold finished bars	33	16	103,290	2.0	408	778,969	2.3	4,282
Tool steel bars	17	17	4,233	0.1	35	33,651	0.1	449
Pipe—Standard	17	18	200,080	3.9	3,975	1,187,693	3.5	28,682
Pipe—Line	12	19	203,414	3.9	707	1,191,006	3.6	10,612
Pipe—Oil country goods	14	20	136,741	2.7	8,105	804,391	2.4	48,323
Tubes—Boiler	3	21	11,276	0.2	752	65,651	0.2	5,500
Tubes—Mechanical and pressure	21	22	53,674	1.0	1,420	402,891	1.2	10,694
Miscellaneous pipe (including conduit)	12	23	17,466	0.3	17	140,152	0.4	972
Wire—Drawn	38	24	168,182	3.3	8,203	1,188,442	3.5	73,899
Wire—Nails and staples	17	25	67,904	1.3	296	445,594	1.3	5,317
Wire—Barbed and twisted	15	26	22,222	0.4	-	138,116	0.4	32
Wire—Woven wire fence	13	27	37,667	0.7	-	231,923	0.7	1,480
Wire—Bale ties	11	28	4,570	0.1	-	27,208	0.1	-
Black plate	10	29	29,762	0.6	-	298,292	0.9	254
Tin and terne plate—Hot dipped	10	30	180,271	3.5	-	900,349	2.7	10
Tin plate—Electrolytic	10	31	206,549	4.0	-	1,005,172	3.0	42
Sheets—Hot rolled	28	32	525,024	10.1	58,283	3,628,603	10.8	372,688
Sheets—Cold rolled	16	33	616,922	11.9	1,121	3,596,748	10.7	11,725
Sheets—Galvanized	15	34	158,401	3.1	27	877,485	2.6	418
Sheets—Long terne	9	35	14,090	0.3	152	80,589	0.2	505
Sheets—Enameling	7	36	12,106	0.2	378	105,293	0.3	1,631
Sheets—Electrical	11	37	28,214	0.6	-	221,214	0.7	-
Strip—Hot rolled	23	38	149,642	2.9	23,331	916,318	2.7	158,153
Strip—Cold rolled	34	39	120,524	2.3	2,318	882,977	2.6	12,574
All other	4	40	1,193	-	-	7,232	-	-
Total steel products	138	41	5,177,259	100.0	381,661	33,633,668	100.0	3,090,548

During 1948 the companies included above represented 99.5 % of the total output of finished rolled steel products as reported to the American Iron and Steel Institute.

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Nonferrous METALS OUTLOOK

Government authorities reviewing program to decontrol tin . . . Lead price again rises . . . Senate Committee meets on tariff for copper and scrap.

by John Anthony

Market Activities

New York—The program for the release of tin from government control has been worked out in detail, it is learned, and is now being reviewed by government attorneys. There is some possibility that controls may be ended in another week or two, or in any event by September.

The question of price after decontrol is still very much a matter of opinion. Most observers believe that the matter of sterling convertibility will not exert any important effect on the price of tin in dollars. Sterling futures in December are being quoted at the rate of $3.79½ in comparison with the spot exchange rate of $4.03. Past experience has indicated that when sterling is devalued the price of tin in terms of sterling is merely raised to bring the equivalent return in other currencies.

The biggest factors in the future price of tin after decontrol, most observers agree, will still concern the manner in which purchases for the stockpile will be made and the relative standing of world supply and demand. At present it appears that competition among producing nations for the tin market might well bring about some reductions in price, unless there is a marked pick up in world consumption rates or if stockpile purchases are made without permitting the market to seek its own level.

Domestic consumption by tinplate producers, who are the major consumers in the market, has been holding up fairly well. Consumption by mixers is way down. There is not much chance of an important improvement in the consumption of this segment of the market while the price remains over a dollar a pound. There are very few factors in the market who believe that decontrol will release any important new business.

NONFERROUS METALS PRICES

	Aug. 3	Aug. 4	Aug. 5	Aug. 6	Aug. 8	Aug. 9
Copper, electro, Conn.	17.625	17.625	17.625	17.625	17.625	17.625
Copper, Lake, Conn.	17.75	17.75	17.75	17.75	17.75	17.75
Tin, Grade A, New York	$1.03	$1.03	$1.03	$1.03	$1.03	$1.03
Zinc, East St. Louis	10.00	10.00	10.00	10.00	10.00	10.00
Lead, St. Louis	14.55	14.55	14.55	14.55	14.80-14.975	14.80-14.975

Note: Quotations are going prices.

Lead Price Jumps to 15c

An increase of ⅜¢ per lb in the price of lead was taken by a custom smelter on Aug. 8, bringing its New York price to 15⅛¢ and at St. Louis to 14.975¢. The St. Joseph Lead Co. followed with a rise in price to 13.80¢ St. Louis, which brings their price at New York to 15.00¢. For the present time, St. Joe expects to hold this price. This means that there will be a price spread in lead for the time being in view of the heavy current demand.

The lead market has been very active. July sales are expected to reach 96,000 to 97,000 tons. Buying of zinc and copper are also reported to be active, but price changes have not been made in either metal.

Conflicting Views on Tariff At Meeting

At the meeting of the Senate Finance Committee last Thursday and Friday conflicting metal interests presented their views of the measures to reimpose a duty on copper and to suspend the duty on metal scrap.

Domestic producers of copper, through their representatives, took the position that the copper tariff should be reinstated. Sen. McFarland of Arizona recommended an increase in the tariff to 4¢ to 6¢ per lb. Custom smelters and consumers took the position that the tariff suspension should be continued.

Primary Metals

(Cents per lb, unless otherwise noted)

Aluminum, 99+%, 10,000 lb, freight allowed	17.00
Aluminum pig	16.00
Antimony, American, Laredo, Tex.	38.50
Beryllium copper, 3.75-4.25% Be dollars per lb contained Be	$24.50
Beryllium aluminum 5% Be, dollars per lb contained Be	$52.00
Bismuth, ton lots	$2.00
Cadmium, del'd	$2.00
Cobalt, 97-99% (per lb)	$1.80 to $1.87
Copper, electro, Conn. Valley	17.625
Copper, lake, Conn. Valley	17.75
Gold, U. S. Treas., dollars per oz.	$35.00
Indium, 99.8%, dollars per troy oz.	$2.25
Iridium, dollars per troy oz.	$100 to $110
Lead, St. Louis	14.80 to 14.975
Lead, New York	15.00 to 15.125
Magnesium, 99.8+%, f.o.b. Freeport, Tex.	20.50
Magnesium, sticks, carlots	34.50
Mercury, dollars per 76-lb flask f.o.b. New York	$75 to $78
Nickel, electro, f.o.b. New York	42.93
Palladium, dollars per troy oz.	$24.00
Platinum, dollars per troy oz.	$69 to $72
Silver, New York, cents per oz.	71.50
Tin, Grade A, New York	$1.03
Zinc, East St. Louis	10.00
Zinc, New York	10.70
Zirconium copper, 10-12 pct Zr, per lb contained Zr	$12.00

Remelted Metals

Brass Ingot

(Published prices, cents per lb delivered, carloads)

85-5-5-5 ingot		
No. 115	13.75*	16.00
No. 120	13.25*	15.50
No. 123	12.75*	15.00
80-10-10 ingot		
No. 305	....	20.50
No. 315	....	17.50
88-10-2 ingot		
No. 210	....	27.00
No. 215	....	24.00
No. 245	16.50*	19.25
Yellow ingot		
No. 405	11.50*	13.75
Manganese bronze		
No. 421	....	18.50

*F.o.b. Philadelphia.

Aluminum Ingot

(Cents per lb, lots of 30,000 lb)

95-5 aluminum-silicon alloys	
0.30 copper, max.	18.75-19.00
0.60 copper, max.	18.50-18.75
Piston alloys (No. 122 type)	16.75
No. 12 alum. (No. 2 grade)	15.25
108 alloy	16.00-16.25
195 alloy	17.00
13 alloy	18.50-18.75
AXS-679	16.50
5% Tl, Aluminum, f.o.b., Eddystone, Pa.	
Low copper	31.00
2% copper	28.00
Steel deoxidizing aluminum, notch-bar granulated or shot	
Grade 1—95-97½%	16.50-17.00
Grade 2—92-95%	15.50-16.00
Grade 3—90-92%	14.50-15.00
Grade 4—85-90%	13.50-14.00

Electroplating Supplies

Anodes

(Cents per lb, freight allowed, in 500 lb lots)

Copper	
Cast, oval, 15 in. or longer	34⅝
Electrodeposited	28⅞
Rolled, oval, straight, delivered	31.46
Ball anodes	32⅞
Brass, 80-20	
Cast, oval, 15 in. or longer	30⅝
Zinc, oval, 99.886, f.o.b. Detroit	17¼
Ball anodes	16¼
Nickel 99 pct plus	
Cast	59.00
Rolled, depolarized	60.00
Cadmium	$2.15
Silver 999 fine, rolled, 100 oz lots, per troy oz, f.o.b. Bridgeport, Conn.	79

Chemicals

(Cents per lb, f.o.b. shipping point)

Copper cyanide, 100 lb drum	45.00
Copper sulfate, 99.5 crystals, bbl.	11.10
Nickel salts, single or double, 4-100 lb bags, frt allowed	18.00
Nickel chloride, 300 lb bbl	24.50
Silver cyanide, 100 oz lots, per oz.	59
Sodium cyanide, 96 pct domestic 200 lb drums	19.25
Zinc sulfate, crystals, 22.5 pct, bags	6.75
Zinc sulfate, 25 pct, flakes, bbl.	7.75

Mill Products

Aluminum

(Base prices, cents per pound, base 30,000 lb, f.o.b. shipping point, freight allowed)

Flat Sheet: 0.188 in., 2S, 3S, 26.9¢; 4S, 61S-O, 28.8¢; 52S, 30.9¢; 24S-O, 24S-OAL, 29.8¢; 75S-O, 75S-OAL, 36.3¢; 0.081 in., 2S, 3S, 27.9¢; 4S, 61S-O, 30.2¢; 52S, 32.3¢; 24S-O, 24S-OAL, 30.9¢; 75S-O, 75S-OAL, 38¢; 0.032 in., 2S, 3S, 29.5¢; 4S, 61S-O, 33.5¢; 52S, 36.2¢; 24S-O, 24S-OAL, 37.9¢; 75S-O, 75S-OAL, 47.6¢.

Plate: ¼ in. and heavier: 2S, 3S, F, 23.8¢; 4S-F, 26¢; 52S-F, 27.1¢; 61S-O, 26.6¢; 24S-F, 24S-FAL, 27.1¢; 75S-F, 75S-FAL, 33.9¢.

Extruded Solid Shapes: Shape factors 1 to 4, 33.6¢ to 64¢; 11 to 13, 34.6¢ to 76¢; 23 to 25, 36.7¢ to $1.05; 35 to 37, 44¢ to $1.53; 47 to 49, 63.5¢ to $2.20.

Rod, Rolled: 1.064 to 4.5 in., 2S-F, 3S-F, 34¢ to 30.5¢; Cold-finished, 0.375 to 3.5 in., 2S, 3S, 36.5¢ to 32¢.

Screw Machine Stock: Drawn, ¼ to 11/32 in., 11S-T3, R317-T4, 49¢ to 38¢; cold-finished, ⅜ to 1½ in., 11S-T3, 37.5¢ to 35.5¢; ⅜ to 2 in., R317-T4, 37.5¢ to 34.5¢; rolled, 1 9/16 to 3 in., 11S-T3, 35.5¢ to 32.5¢; 2⅛ to 3⅜ in., R317-T4, 33.5¢ to 32.5¢. Base 5000 lb.

Drawn Wire: Coiled, 0.051 to 0.374 in.: 2S, 36¢ to 26.5¢; 52S, 44¢ to 32¢; 56S, 47¢ to 33.5¢; 17S-T4, 50¢ to 34.5¢; 61S-T4, 44.5¢ to 34¢; 75S-T6, 76¢ to 55¢.

Magnesium

(Cents per lb, f.o.b. mill, freight allowed Base quantity 30,000 lb)

Sheets and Plate: Ma. FSa, ¼ in., 54¢-56¢; 0.188 in., 56¢-58¢; B & S gage 8, 58¢-60¢; 10, 59¢-61¢; 12, 63¢-65¢; 14, 69¢-74¢; 16, 76¢-81¢; 18, 84¢-89¢; 20, 96¢-$1.01; 22, $1.22-$1.31; 24, $1.62-$1.75. Specification grade higher.

Extruded Round Rod: M, diam in., ¼ to 0.311, 58¢; ⅓ to ¾, 46¢; 1¼ to 1.749, 43¢; 2¼ to 5, 41¢. Other alloys higher.

Extruded Square, Hex. Bar: M, size across flats, in., ¼ to 0.311, 61¢; ⅓ to 0.749, 48¢; 1¼ to 1.749, 44¢; 2½ to 4, 42¢. Other alloys higher.

Extruded Solid Shapes, Rectangle: M, in weight per ft, for perimeters of less than size indicated, 0.10 to 0.11 lb per ft, per. up to 3.5 in., 55¢; 0.22 to 0.25 lb per ft, per. up to 5.9 in., 51¢; 0.50 to 0.59 lb per ft, per. up to 8.6 in., 47¢; 1.8 to 2.59 lb per ft, per. up to 19.5 in., 44¢; 4 to 6 lb per ft, per. up to 28 in., 43¢. Other alloys higher.

Extruded Round Tubing: M, wall thickness, outside diam, in., 0.049 to 0.057, ¼ to 5/16, $1.14; 5/16 to ⅝, $1.02; ½ to ⅝, 76¢; 1 to 2 in., 65¢; 0.065 to 0.082, ⅜ to 7/16, 85¢; ⅝ to ¾, 62¢; 1 to 2 in., 57¢; 0.165 to 0.219, ⅝ to ¾, 54.5¢; 1 to 2 in., 53¢; 3 to 4 in., 49¢. Other alloys higher.

Nickel and Monel

(Base prices, cents per lb, f.o.b. mill)

	Nickel	Monel
Sheets, cold rolled	60	47
Strip, cold-rolled	66	50
Rods and bars	56	45
Angles, hot-rolled	56	45
Plates	58	46
Seamless tubes	89	80
Shot and blocks	..	40

Copper, Brass, Bronze

(Cents per pound, freight prepaid on 200 lb)

	Sheets	Rods	Extruded Shapes
Copper	31.30	....	30.90
Copper, hot-rolled	....	27.15	....
Copper, drawn	....	28.40	....
Low brass	29.47	29.16	32.38*
Yellow brass	28.19	27.88	31.20*
Red brass	29.89	29.58	32.80*
Naval brass	33.13	27.19	28.44
Leaded brass	....	22.76	26.85
Commercial bronze	30.84	30.53	33.50*
Manganese bronze	36.63	30.54	32.04
Phosphor bronze	50.47	50.72	....
Muntz metal	21.15	26.71	27.96
Everdur, Herculoy, Olympic, etc	36.19	35.14	....
Nickel silver, 10 pct	39.12	41.41	41.44
Architectural bronze	....	....	26.85

*Seamless tubing.

Scrap Metals

Brass Mill Scrap

(Cents per pound; add ½¢ per lb for shipments of 20,000 to 40,000 lb; add 1¢ for more than 40,000 lb)

	Heavy	Turnings
Copper	14⅝	13⅞
Yellow brass	12	11
Red brass	13¼	12½
Commercial bronze	13½	12¾
Manganese bronze	11⅝	10⅞
Leaded brass rod ends	11¾	....

Custom Smelters' Scrap

(Cents per pound, carload lots, delivered to refinery)

No. 1 copper wire	14.00 to 14.25
No. 2 copper wire	13.00 to 13.25
Light copper	12.00 to 12.25
Refinery brass	12.00*
Radiators	8.75 to 9.00

*Dry copper content.

Ingot Makers' Scrap

(Cents per pound, carload lots, delivered to producer)

No. 1 copper wire	14.00
No. 2 copper wire	13.00
Light copper	12.00
No. 1 composition	10.50 to 10.75
No. 1 comp. turnings	10.00 to 10.25
Rolled brass	9.00
Brass pipe	9.50
Radiators	8.75 to 9.00
Heavy yellow brass	7.75 to 8.00
Aluminum	
Mixed old cast	9.00
Mixed old clips	9.25
Mixed turnings, dry	8.00
Pots and pans	9.00
Low copper	11.50

Dealers' Scrap

(Dealers' buying prices, f.o.b. New York in cents per pound)

Copper and Brass

No. 1 heavy copper and wire	12½—12¾
No. 2 heavy copper and wire	11½—11¾
Light copper	10½—10¾
Auto radiators (unsweated)	7½— 7¾
No. 1 composition	8¾— 9
No. 1 composition turnings	8¼— 8½
Clean red car boxes	7½— 7¾
Cocks and faucets	7½— 7¾
Mixed heavy yellow brass	6¼— 6½
Old rolled brass	7 — 7¼
Brass pipe	7¾— 8
New soft brass clippings	10 —10½
Brass rod ends	7¾— 8
No. 1 brass rod turnings	7½— 7¾

Aluminum

Alum. pistons and struts	3¾— 4
Aluminum crankcases	6 — 6½
2S aluminum clippings	10 —10½
Old sheet and utensils	6 — 6½
Borings and turnings	3½
Misc. cast aluminum	6 — 6½
Dural clips (24S)	6 — 6½

Zinc

New zinc clippins	5½— 6
Old zinc	3½— 4
Zinc routings	2½— 3
Old die cast scrap	2½

Nickel and Monel

Pure nickel clippings	16 —17
Clean nickel turnings	14 —15
Nickel anodes	16 —17
Nickel rod ends	16 —17
New Monel clippings	10½—11½
Clean Monel turnings	6 — 7
Old sheet Monel	8 — 9
Old Monel castings	7 — 8
Inconel clippings	10 —11
Nickel silver clippings, mixed	6 — 7
Nickel silver turnings, mixed	5½— 6

Lead

Soft scrap, lead	10⅞—11⅜
Battery plates (dry)	6½— 7

Magnesium

Segregated solids	9 —10
Castings	5½— 6½

Miscellaneous

Block tin	70 —72
No. 1 pewter	47 —49
No. 1 auto babbitt	40 —42
Mixed common babbitt	11½—12
Solder joints	10½—11
Siphon tops	45 —47
Small foundry type	12¾—13¼
Monotype	12 —12½
Lino. and stereotype	11½—12
Electrotype	10 —10½
New type shell cuttings	10¼—10¾
Hand picked type shells	4
Lino. and stereo. dross	5½— 5⅝
Electro. dross	4½— 4½

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MARKETS—PRICES—TRENDS

SCRAP
Iron & Steel

Price Advance Extends to More Grades

New York—Scrap prices followed last week's advance in most major markets. Foundry grades were still in strong demand with prices up $5.00 a ton in Chicago, Buffalo, Cleveland and Birmingham. Mill buying has not developed in all districts. Quotations for No. 1 heavy melting steel were off $3.00 in San Francisco; in New York it was up another $1.00; in Pittsburgh it was quoted at $21.00, up 50¢ on the low side; and in Chicago and Philadelphia it remained unchanged. THE IRON AGE scrap composite is up another 8¢ per gross ton to $20.00 per gross ton.

PITTSBURGH—Although mill buying was practically nonexistent, the market here showed a definitely strong undertone. There was evidence of speculative dealer purchases apparently based on the belief that prices have reached bottom and are due for an upturn. The firm tone extended to railroad lists, cast and turnings. In the absence of a sale, No. 1 heavy melting is a flat $21.00. No. 1 RR. was up $1.00, while No. 1 machinery cast rose 50¢.

CHICAGO—Chicago's hot scrap market didn't cool off much in the past week. New mill sales were scarce but broker buying continued. Typical of how fast things were moving was Carnegie's purchase of short turnings at $3.00 over their last order. Cast scrap again went up sharply and the rail market is exceptionally strong. Speculative buying continued at a reduced rate and observers here predict that before this bull market is spent somebody may get burned—badly.

PHILADELPHIA—Dealer sentiment in this market is still very strong but no buying by mills and foundries has developed at higher prices. One reason that this market hasn't reflected bullish developments in steel grades in other districts is that it is practically restricted to three mill consumers. Nevertheless, dealers say they can't get industrial scrap on bids keyed to quoted prices. Foundry grades are still strong. A reduction of $1.00 is noted in chemical borings. The previous price was based on purchase of a special grade.

NEW YORK—There is definitely a better feeling in the scrap market here after last week's price increase. Foundries continued to do some buying during the week. The mills have not yet entered the market for large tonnage orders. Brokers and dealers both report that scrap is in short supply, with some dealers not willing to sell and others having closed their yards during the past several months. Brokers were paying up to $13.00 to $13.50 for No. 1 heavy melting steel, or another increase of $1.00 a ton.

DETROIT—The market still shows strength, although local mill open market buying is still unreported. Most of the present interest seems to be on the speculative side but it has been noted that these interests have apparently broadened their scope to scrap dealers as well as direct plant purchases. Sale of a substantial tonnage by competitive bidding this week by a large auto plant is expected to substantiate the strength shown here recently. The price of low phosplate in The Iron Age, Aug. 4, should have been $14.50 to $15.00 instead of $12.50 to $13.00.

CLEVELAND—Railroad lists took the lead in what has developed into a broker-dealer market here and in the valley, an anticipatory market being underwritten by large stocks of speculative scrap overhanging it. Foundry grades are stronger as a result of the inventory shakeout of the past 3 months and a little pick-up in castings. Mills insist they will not pay over last month's prices which are generally recognized as being disproportionately low, and predict that brokers with tonnage on the ground will ultimately liquidate at a loss when the present flurry, if it can be called that, subsides. Openhearth and blast furnace prices quoted reflect these influences and are indicative of going prices at press time.

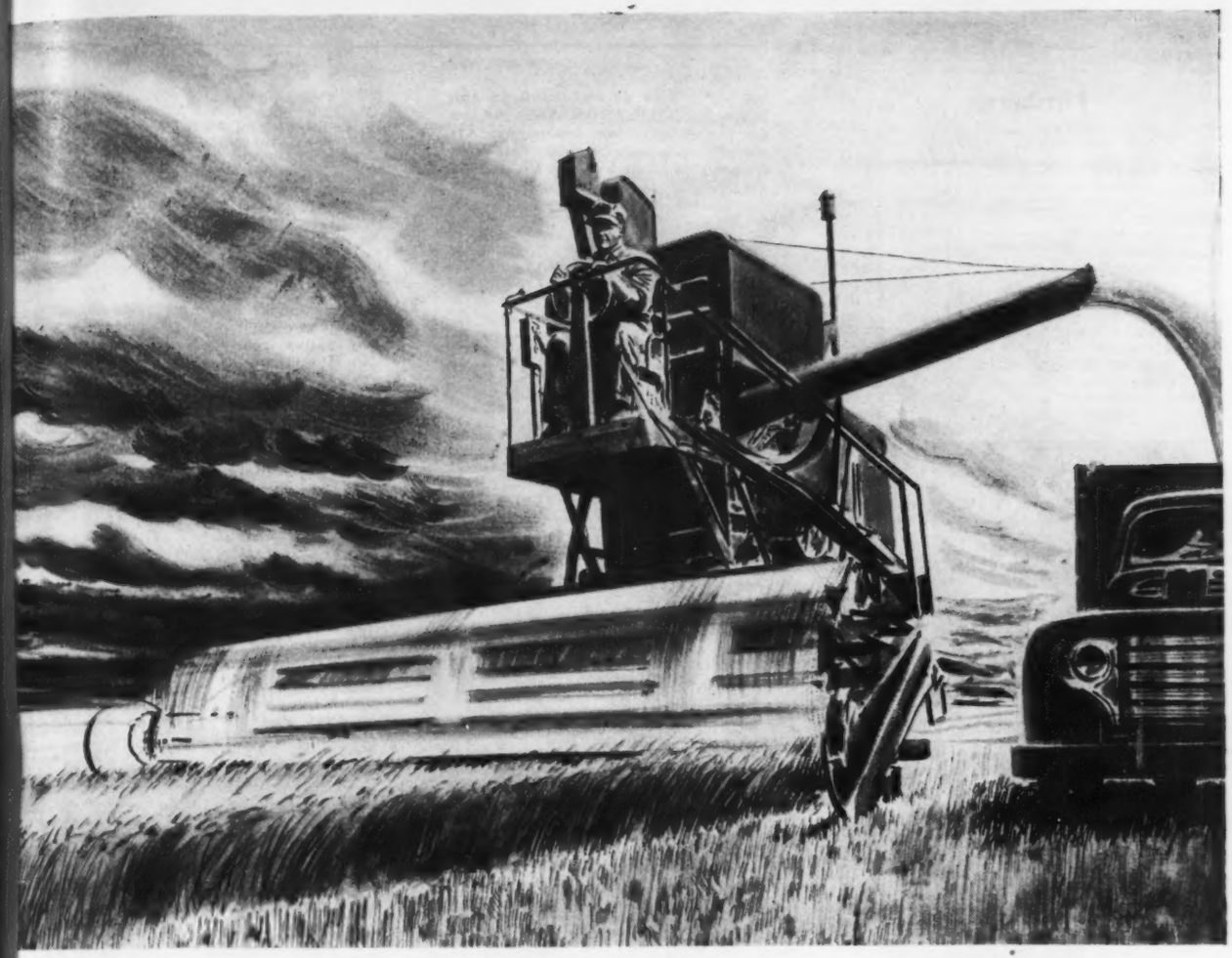
BOSTON—There is definitely a better feeling in the scrap market here. Whether it is temporary or whether the bottom has been reached is the question. At least No. 1 heavy melting steel has moved up from $9.50 to $10.00 to $11.00 to $12.00 range with one prominent dealer buying substantially around $11.50. Other items have hardened somewhat, but cast still has no buyers.

BUFFALO—Prices were jacked up $1.50 to $5.00 this week in a strong broker's market, with cast grades leading the way on numerous queries and some buying by foundries. No. 1 cupola cast jumped to $29.00-$30.00, although the last consumer sales were reported at $25.00 for a few hundred tons. Openhearth scrap climbed $1.50, stimulated by higher bids in territory east of Buffalo for account of a Pittsburgh district consumer. Rail specialties were higher in line with the latest railroad lists. Turnings were comparatively quiet at last week's advance on buying by nearby consumers.

CINCINNATI—Foundry grades were warming up here in a market that apparently picked up sympathetic strength from other districts and is also showing the effects of over-bidding by brokers. Cast grades are definitely stronger. Mills are not buying now, but brokers are paying $1.00 to $2.00 over their old orders to cover on openhearth grades. Dealers are inclined to hold out for higher prices.

BIRMINGHAM—Heavier demand for cast grades with prices going to the highest level in weeks highlights the scrap market here. No. 1 cupola cast is being sold for $33.00 with as much as $33.00 reported being asked by dealers. Foundries, as a result, are increasing purchases of pig iron. Movement of steel grades is slow, with sources for that material apparently expecting a price advance.

ST. LOUIS—Brokers are paying $1.00 a ton more for melting grades of scrap iron than the figures quoted, which offers are being made speculatively or to cover short orders. But local mills have not come into the market yet on that basis. Receipts continue light. Railroads offerings are low because they have tightened their purse strings on maintenance work.



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Dark sky . . . wind . . . devastating rain mean there's no time to lose. So you give 'er everything she's got and pray you'll get in most of the crop before it's too late. That's when the holding power of the 6,377 fasteners in this combine really pay off.

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Because these fasteners are called upon to hold their own on a rugged day-in and day-out schedule, top quality is essential. That's why Russell, Burdsall and Ward with 104 years' experience still carries on intensive research and development work to improve fastener holding power further.

It is unsound economy to use inferior fasteners, since the price of fasteners is such a small part of the total product cost. It isn't the initial price but the cost of *using* fasteners that counts.

To attain *True Fastener Economy*, you can save assembly time, reduce plant inspection, and get the maximum holding power per dollar of fastener cost with a dependable quality fastener. *True Fastener Economy* contributes to the kind of production savings that put more and more combines on U. S. wheatfields every year. It is this type of contribution to major American industries that explains why—for over 104 years—RB&W has been *making strong the things that make America strong.*

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6,377 Fasteners are used in 1 American Combine

104 YEARS MAKING STRONG THE THINGS THAT MAKE AMERICA STRONG

UNIVERSITY OF MICHIGAN LIBRARIES

Going prices as obtained in the trade by THE IRON AGE, based on representative tonnages. All prices are per gross ton delivered to consumer unless otherwise noted.

Aug. 9, 1949

Pittsburgh

No. 1 hvy. melting	$21.00
No. 2 hvy. melting	$18.50 to 19.00
No. 1 bundles	21.00
No. 2 bundles	16.50 to 17.00
Machine shop turn.	14.00 to 15.00
Mixed bor. and ms. turn.	14.00 to 15.00
Shoveling turnings	16.00 to 16.50
Cast iron borings	16.00 to 16.50
Low phos. plate	22.00 to 22.50
Heavy turnings	17.50 to 18.00
No. 1 RR. hvy. melting	21.50 to 22.00
Scrap rails, random lgth.	23.50 to 24.00
Rails 2 ft and under	26.00 to 27.00
RR. steel wheels	24.00 to 25.00
RR. spring steel	24.00 to 25.00
RR. couplers and knuckles	24.00 to 25.00
No. 1 machinery cast.	27.00 to 28.00
Mixed yard cast.	23.00 to 24.00
Heavy breakable cast.	18.50 to 19.00
Malleable	22.50 to 23.00

Chicago

No. 1 hvy. melting	$21.00 to $22.00
No. 2 hvy. melting	19.00 to 20.00
No. 1 factory bundles	21.00 to 22.00
No. 1 dealers' bundles	19.00 to 19.50
No. 2 dealers' bundles	17.00 to 18.00
Machine shop turn.	14.00 to 14.50
Mixed bor. and turn.	14.00 to 14.50
Shoveling turnings	16.00 to 17.00
Cast iron borings	14.00 to 15.00
Low phos. forge crops	26.00 to 26.50
Low phos. plate	24.00 to 25.00
No. 1 RR. hvy. melting	25.00 to 26.00
Scrap rails, random lgth.	31.00 to 32.00
Rerolling rails	35.00 to 36.00
Rails 2 ft and under	34.00 to 35.00
Locomotive tires, cut	29.00 to 30.00
Cut bolsters & side frames	26.00 to 27.00
Angles and splice bars	28.00 to 29.00
RR. steel car axles	34.00 to 35.00
No. 3 steel wheels	26.00 to 27.00
RR. couples and knuckles	26.00 to 27.00
No. 1 machinery cast.	39.00 to 40.00
No. 1 agricul. cast.	38.00 to 39.00
Heavy breakable cast.	33.00 to 34.00
RR. grate bars	22.00 to 23.00
Cast iron brake shoes	23.00 to 24.00
Cast iron car wheels	32.00 to 33.00
Malleable	30.00 to 31.00

Philadelphia

No. 1 hvy. melting	$17.00 to $18.00
No. 2 hvy. melting	16.00 to 16.50
No. 1 bundles	17.00 to 18.00
No. 2 bundles	15.00 to 16.00
Machine shop turn.	11.00 to 12.00
Mixed bor. and turn.	11.00 to 11.50
Shoveling turnings	12.50 to 13.50
Low phos. punchings, plate	20.00 to 21.00
Low phos. 5 ft and under	19.00 to 20.00
Low phos. bundles	17.00 to 18.00
Hvy. axle forge turn.	17.00 to 18.00
Clean cast chem. borings	17.00 to 19.00
RR. steel wheels	22.00 to 22.50
RR. spring steel	22.00 to 22.50
No. 1 machinery cast.	27.00 to 28.00
Mixed yard cast.	24.00 to 25.00
Heavy breakable cast.	23.00 to 24.00
Cast iron carwheels	27.00 to 28.00
Malleable	23.00 to 24.00

Cleveland

No. 1 hvy. melting	$20.50 to $21.00
No. 2 hvy. melting	14.50 to 15.00
No. 1 busheling	20.50 to 21.00
No. 1 bundles	20.50 to 21.00
No. 2 bundles	13.50 to 14.00
Machine shop turn.	9.50 to 10.00
Mixed bor. and turn.	15.50 to 16.00
Shoveling turnings	15.50 to 16.00
Cast iron borings	15.50 to 16.00
Low phos. 2 ft and under	19.00 to 19.50
Steel axle turn.	17.00 to 17.50
Drop forge flashings	17.00 to 17.50
No. 1 RR. hvy. melting	23.00 to 24.00
Rails 3 ft and under	26.00 to 27.00
Rails 18 in. and under	28.00 to 29.00
No. 1 machinery cast	34.00 to 35.00
RR. cast.	34.00 to 35.00
RR. grate bars	23.00 to 24.00
Stove plate	24.00 to 25.00
Malleable	27.00 to 28.00

Youngstown

No. 1 hvy. melting	$21.50 to $22.00
No. 2 hvy. melting	17.00 to 17.50
No. 1 bundles	21.50 to 22.00
No. 2 bundles	15.50 to 16.00
Machine shop turn.	10.00 to 10.50
Shoveling turnings	17.00 to 17.50
Cast iron borings	17.00 to 17.50
Low phos. plate	20.50 to 21.00

Buffalo

No. 1 hvy. melting	$21.00 to $22.00
No. 2 hvy. melting	18.50 to 19.50
No. 1 busheling	18.50 to 19.50
No. 1 bundles	18.50 to 19.50
No. 2 bundles	16.50 to 17.50
Machine shop turn.	11.50 to 12.00
Mixed bor. and turn.	14.50 to 15.00
Shoveling turnings	15.00 to 16.00
Cast iron borings	14.50 to 15.00
Low phos. plate	22.00 to 23.00
Scrap rails, random lgth.	24.00 to 25.00
Rails 18 in. and under	29.00 to 30.00
RR. steel wheels	25.00 to 26.00
RR. spring steel	25.00 to 26.00
RR. couplers and knuckles	25.00 to 26.00
No. 1 cupola cast	29.00 to 30.00
Mixed yard cast	27.00 to 28.00
Stove plate	27.00 to 28.00
Small indus. malleable	19.50 to 20.50

Birmingham

No. 1 hvy. melting	$18.00
No. 2 hvy. melting	18.00
No. 2 bundles	16.00
No. 1 busheling	18.00
Machine shop turn.	13.00
Shoveling turnings	15.00
Cast iron borings	15.00
Bar crops and plate	23.50
Structural and plate	23.50
No. 1 RR. hvy. melt.	$20.00 to 20.50
Scrap rails, random lgth.	20.00
Rerolling rails	23.00 to 24.50
Rails 2 ft and under	25.00 to 26.00
Angles & splice bars	22.00 to 23.00
Std. steel axles	20.00
No. 1 cupola cast	32.00 to 33.00
Stove plate	27.00 to 27.50
Cast iron carwheels	17.00 to 18.00

St. Louis

No. 1 hvy. melting	$21.00 to $22.00
No. 2 hvy. melting	18.00 to 19.00
No. 2 bundled sheets	17.00 to 18.00
Machine shop turn.	10.00 to 11.00
Shoveling turnings	13.00
Rails, random lengths	25.00 to 26.00
Rails 3 ft and under	28.00 to 29.00
Locomotive tires, uncut	21.00 to 22.00
Angles and splice bars	26.00 to 27.00
Std. steel car axles	29.00 to 30.00
RR. spring steel	23.00 to 25.00
No. 1 machinery cast.	29.00 to 31.00
Hvy. breakable cast.	24.00 to 25.00
Cast iron brake shoes	24.00 to 25.00
Stove plate	22.50 to 23.50
Cast iron car wheels	30.00 to 32.00
Malleable	23.00 to 25.00

New York

Brokers' buying prices per gross ton, on cars:

No. 1 hvy. melting	$13.00 to $13.50
No. 2 hvy. melting	12.00 to 12.50
No. 2 bundles	11.00 to 11.50
Machine shop turn.	6.50 to 7.00
Mixed bor. and turn.	5.25 to 5.75
Shoveling turnings	7.00 to 8.00
Clean cast chem. bor.	11.00 to 12.00
No. 1 machinery cast	20.00 to 20.50
Mixed yard cast	18.00 to 19.00
Charging box cast	17.00 to 18.00
Heavy breakable cast	17.00 to 18.00
Unstrp. motor blocks	14.50 to 15.00

Boston

Brokers' buying prices per gross ton, on cars:

No. 1 hvy. melting	$11.00 to $12.00
No. 2 hvy. melting	10.00 to 11.00
No. 1 bundles	10.50 to 11.50
No. 2 bundles	9.50 to 10.50
Machine shop turn.	5.00 to 5.50
Mixed bor. and turn.	4.00 to 4.50
Shoveling turnings	6.00 to 6.50
No. 2 busheling	8.50 to 9.00
Clean cast chem. borings	11.00
No. 1 machinery cast	27.00 to 29.00
No. 2 machinery cast	19.00 to 22.50
Heavy breakable cast	16.00 to 17.00
Stove plate	18.50 to 20.50

Detroit

Brokers' buying prices per gross ton, on cars:

No. 1 hvy. melting	$14.50 to $15.00
No. 2 hvy. melting	12.50 to 13.00
No. 1 bundles	14.50 to 15.00
New busheling	14.50 to 15.00
Flashings	14.50 to 15.00
Machine shop turn.	8.00 to 8.50
Mixed bor. and turn.	8.00 to 8.50
Shoveling turnings	9.00 to 9.50
Cast iron borings	9.00 to 9.50
Low phos. plate	14.50 to 15.00*
No. 1 cupola cast	24.00 to 25.00
Heavy breakable cast.	18.00 to 20.00
Stove plate	17.00 to 19.00
Automotive cast.	24.00 to 26.00

*Aug. 4 quotation should have read $14.50 to $15.00.

Cincinnati

Per gross ton, f.o.b. cars:

No. 1 hvy. melting	$16.50 to $17.00
No. 2 hvy. melting	15.50 to 16.00
No. 1 bundles	16.50 to 17.00
No. 2 bundles	13.00 to 14.00
Machine shop turn.	8.00 to 9.00
Mixed bor. and turn.	8.00 to 9.00
Shoveling turnings	9.00 to 10.00
Cast iron borings	9.00 to 10.00
Low phos. 18 in. under	27.00 to 27.50
Rails, random lengths	24.00 to 24.50
Rails, 18 in. and under	32.50 to 33.50
No. 1 cupola cast.	27.00 to 28.00
Hvy. breakable cast.	23.00 to 24.00
Drop broken cast.	32.50 to 33.50

San Francisco

No. 1 hvy. melting	$17.00
No. 2 hvy. melting	15.00
No. 1 bundles	13.00
No. 2 bundles	13.00
No. 3 bundles	10.00
Machine shop turn.	10.00
Elec. fur. 1 ft and under	25.00
No. 1 RR. hvy. melting	18.00
Scrap rails, random lgth.	20.00
No. 1 cupola cast	$20.00 to 25.00

Los Angeles

No. 1 hvy. melting	$20.00
No. 2 hvy. melting	18.00
No. 1 bundles	16.00
No. 2 bundles	16.00
No. 3 bundles	13.00
Mach. shop turn.	12.00
Elec. fur. 1 ft and under	30.00
No. 1 RR. hvy. melting	20.00
No. 1 cupola cast	$24.00 to 28.00

Seattle

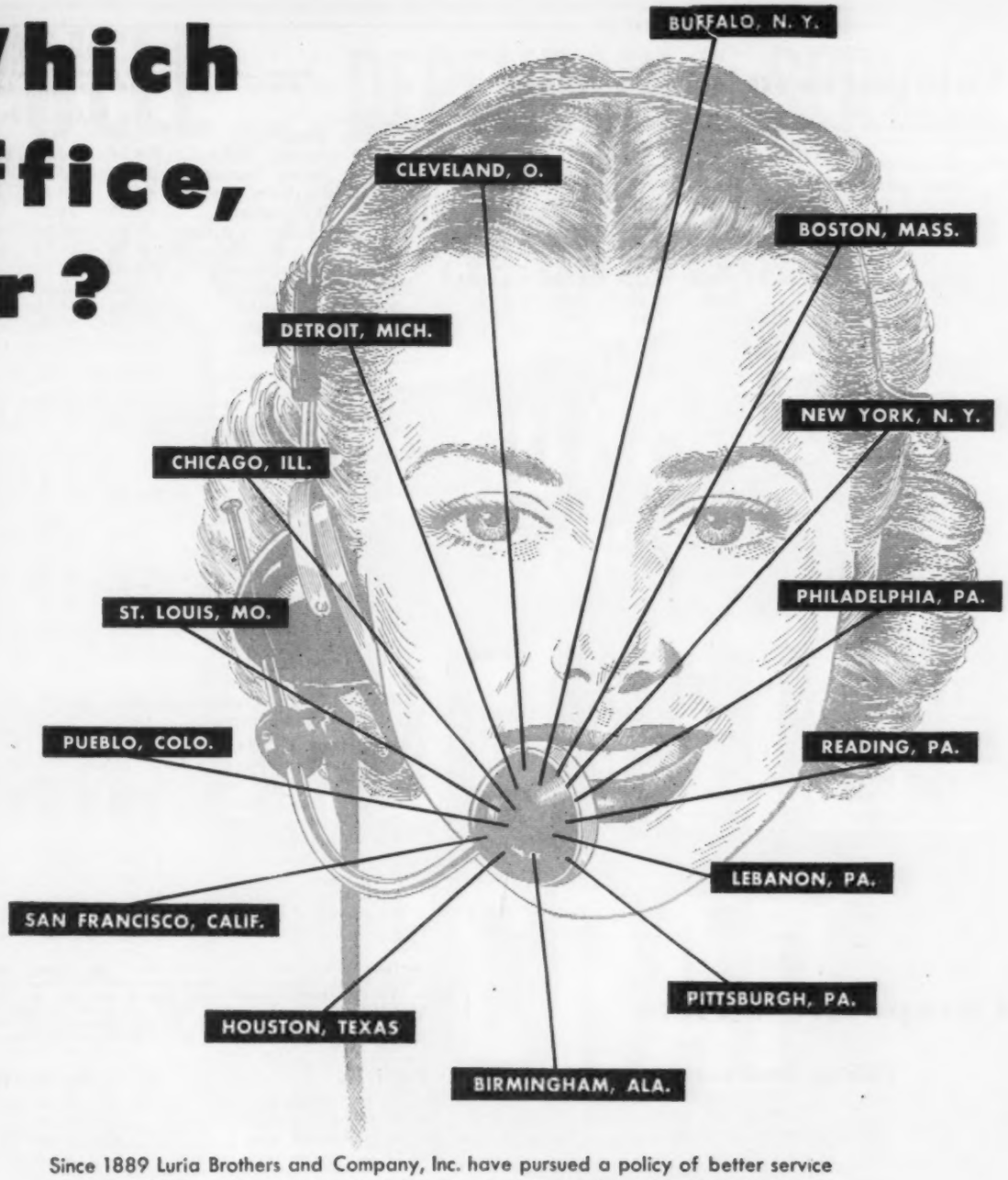
No. 1 hvy. melting	$16.00
No. 2 hvy. melting	16.00
No. 1 bundles	15.00
No. 2 bundles	15.00
No. 3 bundles	12.00
Elec. fur. 1 ft and under	21.00
RR. hvy. melting	19.00
No. 1 cupola cast	$20.00 to 27.00
Heavy breakable cast	20.00

Hamilton, Ont.

Cast grades f.o.b. shipping point:

No. 1 hvy. melting	$21.00
No. 1 bundles	21.00
No. 2 bundles	20.50
Mechanical bundles	19.00
Mixed steel scrap	17.00
Mixed bor. and turn.	15.00
Rails, remelting	21.00
Rails, rerolling	24.00
Bushelings	15.50
Bush., new fact, prep'd	19.00
Bush., new fact, unprep'd.	14.00
Short steel turnings	15.00
Cast scrap	$25.00 to 26.00

Which office, sir?



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LEADERS IN IRON AND STEEL SCRAP SINCE 1889

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Comparison of Prices

Steel prices on this page are the average of various f.o.b. quotations of major producing areas: Pittsburgh, Chicago, Gary, Cleveland, Youngstown.

Flat-Rolled Steel: (cents per pound)	Aug. 9, 1949	Aug. 2, 1949	July 12, 1949	Aug. 10, 1948
Hot-rolled sheets	3.25	3.25	3.25	3.26
Cold-rolled sheets	4.00	4.00	4.00	4.00
Galvanized sheets (10 ga)	4.40	4.40	4.40	4.40
Hot-rolled strip	3.25	3.25	3.25	3.265
Cold-rolled strip	4.038	4.038	4.038	4.063
Plates	3.40	3.40	3.40	3.42
Plates wrought iron	7.85	7.85	7.85	7.85
Stains C-R strip (No. 302)	33.25	33.25	33.25	33.25
Tin and Terneplate: (dollars per base box)				
Tinplate (1.50 lb) cokes	$7.75	$7.75	$7.75	$6.80
Tinplate, electro (0.50 lb)	6.70	6.70	6.70	6.00
Special coated mfg. ternes	6.65	6.65	6.65	5.90
Bars and Shapes: (cents per pound)				
Merchant bars	3.35	3.35	3.35	3.37
Cold-finished bars	3.995	3.995	3.995	3.995
Alloy bars	3.75	3.75	3.75	3.75
Structural shapes	3.25	3.25	3.25	3.25
Stainless bars (No. 302)	28.50	28.50	28.50	28.25
Wrought iron bars	9.50	9.50	9.50	9.50
Wire: (cents per pound)				
Bright wire	4.15	4.15	4.15	4.256
Rails: (dollars per 100 lb)				
Heavy rails	$3.20	$3.20	$3.20	$3.20
Light rails	3.55	3.55	3.55	3.55
Semifinished Steel: (dollars per net ton)				
Rerolling billets	$52.00	$52.00	$52.00	$52.00
Slabs, rerolling	52.00	52.00	52.00	52.00
Forging billets	61.00	61.00	61.00	61.00
Alloy blooms, billets, slabs	63.00	63.00	63.00	63.00
Wire rod and Skelp: (cents per pound)				
Wire rods	3.40	3.40	3.40	3.619
Skelp	3.25	3.25	3.25	3.25

Price advances over previous week are printed in Heavy Type; declines appear in *Italics*.

Pig Iron: (per gross ton)	Aug. 9, 1949	Aug. 2, 1949	July 12, 1949	Aug. 10, 1948
No. 2, foundry, Phila.	$50.56	$50.56	$50.56	$49.26
No. 2, Valley furnace	46.50	46.50	46.50	43.50
No. 2, Southern Cin'ti*	45.47	45.47	45.47	48.14
No. 2, Birmngham	39.38	39.38	39.38	43.38
No. 2, foundry, Chicago†	46.50	46.50	46.50	43.00
Basic del'd Philadelphia*	49.74	49.74	49.74	48.76
Basic, Valley furnace	46.00	46.00	46.00	43.00
Malleable, Chicago†	46.50	46.50	46.50	43.50
Malleable, Valley	46.50	46.50	46.50	43.50
Charcoal, Chicago	73.78	73.78	73.78	69.55
Ferromanganese‡	173.40	173.40	173.40	145.00

†The switching charge for delivery to foundries in the Chicago district is $1 per ton.
‡Average of U. S. prices quoted on Ferroalloy page.
*Does not include interim increase on total freight charges effective Jan. 11, 1949.

Scrap: (per gross ton)				
Heavy melt'g steel, P'gh.	$21.00	$20.75	$20.75	$42.75
Heavy melt'g steel, Phila.	17.50	17.50	17.50	45.00
Heavy melt'g steel, Ch'go	21.50	21.50	19.75	41.75
No. 1, hy. comp. sh't Det.	14.75	14.75	12.75	38.00
Low phos. Young'n	20.75	20.75	20.75	47.75
No. 1, cast, Pittsburgh	27.50	27.00	26.50	65.00
No. 1, cast, Philadelphia	27.50	27.50	27.50	65.50
No. 1, cast, Chicago	39.50	34.50	31.00	74.00
Coke: Connellsville: (per net ton at oven)				
Furnace coke, prompt	$14.25	$14.25	$14.25	$14.00
Foundry coke, prompt	15.75	15.75	16.25	17.00
Nonferrous Metals: (cents per pound to large buyers)				
Copper, electro, Conn.	17.625	17.625	17.625	23.215
Copper, Lake Conn.	17.75	17.75	17.75	23.625
Tin, Grade A, New York	$1.03	$1.03	$1.03	$1.03
Zinc, East St. Louis	10.00	10.00	9.00	15.00
Lead, St. Louis	14.80	14.55	13.35	19.30
Aluminum, virgin	17.00	17.00	17.00	16.00
Nickel electrolytic	42.93	42.93	42.93	42.90
Magnesium, ingot	20.50	20.50	20.50	20.50
Antimony, Laredo, Tex.	38.50	38.50	38.50	35.00

Composite Prices

Starting with the issue of May 12, 1949, the weighted finished steel composite was revised for the years 1941 to date. The weights used are based on the average product shipments for the 7 years 1937 to 1940 inclusive and 1946 to 1948 inclusive. The use of quarterly figures has been eliminated because it was too sensitive, see p. 139 of May 12, 1949, issue.

	Finished Steel Base Price	Pig Iron	Scrap Steel
Aug. 9, 1949	3.705¢ per lb.	$45.91 per gross ton	$20.00 per gross ton
One week ago	3.705¢ per lb.	$45.91 per gross ton	$19.92 per gross ton
One month ago	3.705¢ per lb.	$45.91 per gross ton	$19.33 per gross ton
One year ago	3.720¢ per lb.	$44.11 per gross ton	$43.16 per gross ton

	Finished Steel High	Finished Steel Low	Pig Iron High	Pig Iron Low	Scrap Steel High	Scrap Steel Low
1949	3.720¢ Jan. 1	3.705¢ May 3	$46.82 Jan. 4	$45.91 May 10	$43.00 Jan. 1	$19.33 June 2
1948	3.721¢ July 27	3.193¢ Jan. 1	46.91 Oct. 12	39.58 Jan. 6	43.16 July 27	39.75 Mar. 1
1947	3.193¢ July 29	2.848¢ Jan. 1	37.98 Dec. 30	30.14 Jan. 7	42.58 Oct. 28	29.50 May 2
1946	2.848¢ Dec. 31	2.464¢ Jan. 1	30.14 Dec. 10	25.37 Jan. 1	31.17 Dec. 24	19.17 Jan. 1
1945	2.464¢ May 29	2.396¢ Jan. 1	25.37 Oct. 23	23.61 Jan. 2	19.17 Jan. 2	18.92 May 2
1944	2.396¢	2.396¢	$23.61	$23.61	19.17 Jan. 11	15.76 Oct. 3
1943	2.396¢	2.396¢	23.61	23.61	$19.17	$19.17
1942	2.396¢	2.396¢	23.61	23.61	19.17	19.17
1941	2.396¢	2.396¢	$23.61 Mar. 20	$23.45 Jan. 2	$22.00 Jan. 7	$19.17 Apr. 1
1940	2.30467¢ Jan. 2	2.24107¢ Apr. 16	23.45 Dec. 23	22.61 Jan. 2	21.83 Dec. 30	16.04 Apr. 1
1939	2.35367¢ Jan. 3	2.26689¢ May 16	22.61 Sept. 19	20.61 Sept. 12	22.50 Oct. 3	14.08 May 1
1938	2.58414¢ Jan. 4	2.27207¢ Oct. 18	23.25 June 21	19.61 July 6	15.00 Nov. 22	11.00 June
1937	2.58414¢ Mar. 9	2.32263¢ Jan. 4	23.25 Mar. 9	20.25 Feb. 16	21.92 Mar. 30	12.67 June
1936	2.32263¢ Dec. 28	2.05200¢ Mar. 10	19.74 Nov. 24	18.73 Aug. 11	17.75 Dec. 21	12.67 June
1935	2.07642¢ Oct. 1	2.06492¢ Jan. 8	18.84 Nov. 5	17.83 May 14	13.42 Dec. 10	10.33 Apr. 2
1934	2.15367¢ Apr. 24	1.95757¢ Jan. 2	17.90 May 1	16.90 Jan. 27	13.00 Mar. 13	9.50 Sept. 2
1933	1.95578¢ Oct. 3	1.75836¢ May 2	16.90 Dec. 5	13.56 Jan. 3	12.25 Aug. 8	6.75 Jan.
1932	1.89196¢ July 5	1.83901¢ Mar. 1	14.81 Jan. 5	13.56 Dec. 6	8.50 Jan. 12	6.43 July
1931	1.99626¢ Jan. 13	1.86586¢ Dec. 29	15.90 Jan. 6	14.79 Dec. 15	11.33 Jan. 6	8.50 Dec. 2
1929	2.31773¢ May 28	2.26498¢ Oct. 29	18.71 May 14	18.21 Dec. 17	17.58 Jan. 29	14.08 Dec.

Weighted index based on steel bars, shapes, plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing major portion of finished steel shipments. Index recapitulated in Aug. 28, 1941, issue and in May 12, 1949.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Birmingham.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

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STEEL PRICES

PRODUCTS	Base prices at producing points apply to the sizes and grades produced in these areas														
	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio		Detroit	Johnstown	Seattle, S. Frisco, LosAngeles	Fontana
INGOTS Carbon forging	$50.00											150.00			
Alloy	$51.00						(per net ton)					$51.00			
BILLETS, BLOOMS, SLABS Carbon, rerolling[10]	$52.00				$52.00	$52.00	(per net ton)						$82.00		$71.00
Carbon forging billets	$61.00	$61.00	$61.00	$61.00	$61.00	$61.00	(per net ton)					$61.00	$61.00		$80.00
Alloy	$63.00	$63.00				$63.00	(Bethlehem, Canton, Massillon = $63.00) (per net ton)					$63.00			$82.00
PIPE SKELP	3.25						3.25				Warren = 3.25				
WIRE RODS	3.40	3.40		3.40	3.40		3.40	3.50			Worcester 3.70		3.40	4.05[11] 4.20[12]	
SHEETS Hot-rolled[4]	3.25	3.25	3.25	3.25	3.25	3.25 (Conshohocken,	3.25 Pa. 3.35)	3.25		Warren, Ashland = 3.25		3.45		3.95[13]	4.10
Cold-rolled	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.20	4.00	Warren 4.00	4.20		Pittsburg, Cal. 4.95	4.90
Galvanized (10 gage)	4.40	4.40	4.40		4.40			4.40	Canton =4.40	4.40	Ashland =4.40			5.15[13]	
Enameling (12 gage)	4.40	4.40	4.40	4.40			4.40		4.60	4.40		4.70			
Long ternes (10 gage)	4.80		4.80							4.80					
STRIP Hot-rolled[1]	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25		3.25	Warren = 3.25	3.45		4.00 to 4.25	4.00
Cold-rolled[2]	4.00	4.15		4.00		4.00	4.00	4.00		New Haven 4.50 Warren = 4.00 to 4.25		4.20 to 4.25			4.90
TINPLATE Cokes, 1.50 lb.[3] base box	$7.75	$7.75	$7.75		$7.85			$7.85	$7.85	Warren, Ohio =$7.75				Pittsburg, Cal. =$8.50	
Electrolytic 0.25, 0.50, 0.75 lb. box	Deduct $1.30, $1.05 and 75¢ respectively from 1.50 lb. coke base box price														
TERNES MFG., special coated	Deduct $1.10 from 1.50 lb. coke base box price														
BLACKPLATE CANMAKING 55 to 128 lb.	Deduct $2.00 from 1.50 lb. coke base box price														
BLACKPLATE, h.o., 29 ga.[8]	5.30	5.30	5.30					5.40		Warren, Ohio =5.30					
BARS Carbon Steel	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35		3.35	Canton =3.35	3.55	3.35	4.05 to 4.10[14]	4.00
Reinforcing[5]	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35			Canton =3.35		3.35	4.05[14] to 4.10	4.00
Cold-finished[6]	3.95 to 4.00	4.00	4.00	4.00		4.00	4.00					4.30			
Alloy, hot-rolled	3.75	3.75	3.75			3.75	3.75	Bethlehem, Canton, Massillon = 3.75				4.05	3.75	4.30[12]	4.75
Alloy cold-drawn	4.65	4.65	4.65	4.65		4.65	4.65	Massillon = 4.65			Worcester 4.95				
PLATE Carbon steel[9]	3.40	3.40	3.40	3.40	3.40 Cons	3.40 hohocken	3.40 =3.50	3.40 Coatesville = 3.50, Claymont = 3.50 Geneva = 3.40, Harrisburg = 3.50				3.65	3.40	4.30[14]	4.00
Floor plates	4.55	4.55		4.55				Conshohocken, Harrisburg =4.55							
Alloy	4.40	4.40	4.40						Coatesville = 4.50						
SHAPES Structural	3.25	3.25	3.25		3.25	3.30	Bethlehem = 3.30, Geneva, Utah = 3.25						3.30	3.80 to 3.90[14]	3.80
MANUFACTURERS' WIRE[7] Bright	4.15	4.15		4.15	4.15		4.15	4.25	Duluth = 4.15, Worcester = 4.45				4.15	5.15[11]	
Spring (high carbon)	5.20	5.20		5.20				5.30	Worcester = 5.50 New Haven, Trenton = 5.50				5.20	Duluth = 5.20-5.15	
PILING, Steel sheet	4.05	4.05				4.05									

Steel prices shown above are f.o.b. producing points in cents per pound unless otherwise indicated. Extras apply. (1) Widths up to 12-in. inclusive. (2) 0.25 carbon and less. (3) Cokes, 1.25 lb. deduct 25¢ per base box. (4) 18 gage and heavier. (5) For straight length material only from producers to fabricators. (6) Also shafting. For quantities of 40,000 lb and over. (7) Carload lot in manufacturing trade. (8) Hollowware enameling, gages 29 to 31 only. (9) Produced to dimensional tolerances in AISI Manual Sec. 6. (10) Slab prices subject to negotiation in most cases. (11) San Francisco only. (12) Los Angeles only. (13) San Francisco and Los Angeles only. (14) Seattle only. (15) Seattle and Los Angeles only.

PIPE AND TUBING

Base discounts, f.o.b. mills, Base price, about $200.00 per net ton.

Standard, Threaded and Coupled

	Black	Galv.
Steel, buttweld*		
⅛-in.	43 to 41	26½ to 24½
¼-in.	46 to 44	30½ to 28½
⅜-in.	48½ to 46½	32½ to 31½
½-in.	49 to 47	34 to 32
¾-in.	49½ to 47½	34½ to 32½
1-in.	50 to 48	35 to 33
1¼ to 3-in.	50½ to 48½	35½ to 33½
Steel, lapweld		
1-in.	39½	26 to 24
1¼ to 3-in.	43½ to 42½	28 to 27
3½ to 6-in.	46½ to 42½	31 to 27
Steel, seamless		
⅛-in.	38½ to 27	23 to 11½
¼ to 3-in.	41½ to 32½	26 to 17
3½ to 6-in.	43½ to 38½	28 to 23
Wrought Iron, buttweld		
⅛-in.	+20½	+47
¼-in.	+10½	+36
⅜ & 1¼ in.	+ 4½	+27
1-in.	— 1½	+23½
1¼-in.	— 2	+23
Wrought Iron, lapweld		
1-in.	+ 7½	+31
1¼ to 3½-in.	+ 5	+26½
4-in.	list	+20½
4½ to 8-in.	+ 2	+22

Extra Strong, Plain Ends

Steel, buttweld				
⅛-in.	42	to 40	27	to 25
¼-in.	46	to 44	31	to 29
⅜-in.	48	to 46	34	to 32
½-in.	48½	to 46½	34½	to 32½
¾-in.	49	to 47	35	to 33
1-in.	49½	to 47½	35½	to 34½
1¼ to 3-in.	50	to 48	36	to 34
Steel, lapweld				
1-in.	39½	to 38½	25	to 24
1¼ to 3-in.	44½	to 42½	30	to 28
3½ to 6-in.	48	to 44	33½	to 31½
Steel, seamless				
⅛-in.	37½	to 32½	23	to 18
¼ to 3-in.	41½	to 36½	27	to 23
3½ to 6-in.		45		30½
Wrought Iron, buttweld				
⅛-in.	+16		+40	
¼-in.	+ 9½		+34	
⅜ to 2-in.	— 1½		+23	
Wrought Iron, lapweld				
2-in.	+ 4½		+27½	
2½ to 4-in.	— 5		+16	
4½ to 6-in.	— 1		+20½	

For threads only, buttweld, lapweld and seamless pipe, one point higher discount (lower price) applies. For plain ends, buttweld, lapweld and seamless pipe 3-in. and smaller, three points higher discount (lower price) applies, while for lapweld and seamless 3½-in. and larger four points higher discount (lower price) applies. On buttweld and lapweld steel pipe, jobbers are granted a discount of 5 pct. Fontana, Calif., deduct 11 points from figures in left columns.

BOILER TUBES

Seamless steel and electric welded commercial boiler tubes and locomotive tubes, minimum wall. Prices per 100 ft at mill in carload lots, cut length 4 to 24 ft inclusive.

OD in.	Gage BWG	Seamless H.R.	Seamless C.R.	Electric H.R.	Weld C.D.
2	13	$19.18	$22.56	$18.60	$21.89
2½	12	25.79	30.33	25.02	29.41
3	12	28.68	33.76	27.82	32.74
3½	11	35.85	42.20	34.78	40.94
4	10	44.51	52.35	43.17	50.78

CAST IRON WATER PIPE

Per net ton

4 to 24-in., del'd Chicago	$95.70
4 to 24-in., del'd N. Y.	$92.50 to 97.40
4 to 24-in., Birmingham	82.50
4-in. and larger, f.o.b. cars, San Francisco, Los Angeles, for all rail shipment; rail and water shipment less	109.30

Class "A" and gas pipe, $5 extra; 4-in. pipe is $5 a ton above 6-in.

BOLTS, NUTS, RIVETS, SET SCREWS

Consumer Prices

(Bolts and nuts f.o.b. mill Pittsburgh, Cleveland, Birmingham or Chicago)

Base discount less case lots

Machine and Carriage Bolts

	Pct Off List
½ in. & smaller x 6 in. & shorter	35
9/16 & ⅝ in. x 6 in. & shorter	37
¾ in. & larger x 6 in. shorter	34
All diam., longer than 6 in.	30
Lag, all diam over 6 in. longer	35
Lag, all diam x 6 in. & shorter	37
Plow bolts	47

Nuts, Cold Punched or Hot Pressed

(Hexagon or Square)

½ in. and smaller	35
9/16 to 1 in. inclusive	34
1⅛ to 1½ in. inclusive	32
1⅝ in. and larger	27

On above bolts and nuts, excepting plow bolts, additional allowances of 15 pct for full container quantities. There is an additional 5 pct allowance for carload shipments.

Semifinished Hexagon Nuts

	USS	SAE
7/16 in. and smaller	..	41
½ in. and smaller	38	..
⅝ in. through 1 in.	..	39
9/16 in. through 1 in.	37	
1⅛ in. through 1½ in.	35	37
1⅝ in. and larger	28	..

In full case lots, 15 pct additional discount.

Stove Bolts

Packages, nuts separate	$61.75
In bulk	70.00

Large Rivets

(½ in. and larger)

	Base per 100 lb
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$6.75
F.o.b. Lebanon, Pa.	6.75

Small Rivets

(7/16 in. and smaller)

	Pct off List
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	48

Cap and Set Screws

(In packages)	*Pct Off List*
Hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in., SAE 1020, bright	46
¾ to 1 in. x 6 in., SAE (1035), heat treated	35
Milled studs	19
Flat head cap screws, listed sizes	5
Fillister head cap, listed sizes	28

FLUORSPAR

Washed gravel fluorspar, f.o.b. cars, Rosiclare, Ill.

Effective CaF, Content:	*Base price per net ton*
70% or more	$37.00
60% or less	34.00

LAKE SUPERIOR ORES

(51.50% Fe, Natural Content, Delivered Lower Lake Ports)

	Per gross ton
Old range, bessemer	$7.60
Old range, nonbessemer	7.45
Mesabi, bessemer	7.35
Mesabi, nonbessemer	7.20
High phosphorus	7.20

After Dec. 31, 1948, increases or decreases in Upper Lake freight, dock and handling charges and taxes thereon to be for the buyers' account.

METAL POWDERS

Per pound, f.o.b. shipping point, in ton lots, for minus 100 mesh.

Swedish sponge iron c.i.f. New York, ocean bags	7.9¢ to 9.0¢
Domestic sponge iron, 98+% Fe, carload lots	9.0¢ to 15.0¢
Electrolytic iron, annealed, 99.5+% Fe	31.5¢ to 39.5¢
Electrolytic iron, unannealed, minus 325 mesh, 99+% Fe	48.5¢
Hydrogen reduced iron, minus 300 mesh, 98+% Fe	63.0¢ to 80.0¢
Carbonyl iron, size 5 to 10 microns, 98%, 99.8%+ Fe	90.0¢ to $1.75
Aluminum	27.00¢
Antimony	53.73¢
Brass, 10 ton lots	20.50 to 23.50¢
Copper, electrolytic	27.75¢
Copper, reduced	27.625¢
Cadmium	$2.40
Chromium, electrolytic, 99% min.	$3.50
Lead	20.06¢
Manganese	48.00¢
Molybdenum, 99%	$2.65
Nickel, unannealed	66.00¢
Nickel, spherical, minus 30 mesh, unannealed	68.00¢
Silicon	34.00¢
Solder powder	8.5¢ plus metal cost
Stainless steel, 302	75.00¢
Tin	$1.15 to $1.25
Tungsten, 99%	$2.90
Zinc, 10 ton lots	11.75 to 16.25¢

COKE

	Net Ton
Furnace, beehive (f.o.b. oven) Connellsville, Pa.	$14.00 to $14.50
Foundry, beehive (f.o.b. oven) Connellsville, Pa.	$15.50 to $16.00
Foundry, oven coke	
Buffalo, del'd	$22.90
Chicago, f.o.b.	20.40
Detroit, f.o.b.	19.40
New England, del'd	22.70
Seaboard, N. J., f.o.b.	22.00
Philadelphia, f.o.b.	20.45
Swedeland, Pa., f.o.b.	20.40
Plainesville, Ohio, f.o.b.	20.90
Erie, del'd	$21.50 to 23.50
Cleveland, del'd	22.45
Cincinnati, del'd	21.50
St. Paul, f.o.b.	23.50
St. Louis, del'd	20.98
Birmingham, del'd	18.66

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick

	Carloads, Per 1000
First quality, Pa., Ky., Mo., Ill. (except Salina, Pa., add $5)	$80.00
No. 1 Ohio	74.00
Sec. quality, Pa., Md., Ky., Mo., Ill.	74.00
No. 2 Ohio	66.00
Ground fire clay, net ton, bulk (except Salina, Pa., add $1.50)	11.50

Silica Brick

Mt. Union, Pa., Ensley, Ala.	$80.00
Childs, Pa.	84.00
Hays, Pa.	85.00
Chicago District	89.00
Western, Utah and Calif.	95.00
Super Duty, Hays, Pa., Athens, Tex.	$85.00 to 95.00
Silica cement, net ton, bulk, Eastern (except Hays, Pa.)	$13.75 to 14.00
Silica cement, net ton, bulk, Hays, Pa.	16.00
Silica cement, net ton, bulk, Ensley, Ala.	15.00
Silica cement, net ton, bulk, Chicago District	$14.75 to 15.00
Silica cement, net ton, bulk, Utah and Calif.	21.00

Chrome Brick

	Per Net Ton
Standard chemically bonded, Balt., Chester	$69.00

Magnesite Brick

Standard, Balt. and Chester	$91.00
Chemically bonded, Balt. and Chester	80.00

Grain Magnesite

Std. ⅜-in. grains

Domestic, f.o.b. Balt. and Chester, in bulk, fines removed	$56.00 to 56.50
Domestic, f.o.b. Chewelah, Wash., in bulk with fines	$30.50 to 31.00
in sacks with fines	35.00 to 35.50

Dead Burned Dolomite

F.o.b. producing points in Pennsylvania, West Virginia and Ohio, per net ton, bulk, Midwest, add 10¢: Missouri Valley, add 20¢	$12.25

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STAINLESS STEELS

Base prices, in cents per pound, f.o.b. producing point

Product	Chromium Nickel							Straight Chromium		
	301	302	303	304	316	321	347	410	416	430
Ingots, rerolling	12.75	13.50	16.00	15.50	22.75	18.25	20.00	11.25	13.75	11.50
Slabs, billets, rerolling	17.00	18.25	20.25	19.25	30.25	24.50	26.75	15.00	18.50	15.25
Forg. discs, die blocks, rings	30.50	30.50	33.00	32.00	49.00	36.50	41.00	24.50	25.00	25.00
Billets, forging	24.25	24.25	26.25	25.50	39.00	29.00	32.75	19.50	20.00	30.00
Bars, wire, structurals	28.50	28.50	31.00	30.00	46.00	34.00	38.50	23.00	23.50	23.50
Plates	32.00	32.00	34.80	34.00	50.50	39.50	44.00	26.00	26.50–27.00	26.50
Sheets	37.50	37.50	39.50	39.50	53.00	45.50	50.00	33.00	33.50	35.50
Strip, hot-rolled	24.25	25.75	30.00	27.75	46.00	34.50	38.75	21.25	28.00	21.75
Strip, cold-rolled	30.50	33.00	36.50	35.00	55.00	44.50	48.50	27.00	33.50	27.50

ELECTRODES

Cents per lb, f.o.b. plant, threaded electrodes with nipples, unboxed

Diameter in in.	Length in in.	
Graphite		
17, 18, 20	60, 72	16.00¢
8 to 16	48, 60, 72	16.50¢
7	48, 60	17.75¢
6	48, 60	19.00¢
4, 5	40	19.50¢
3	40	20.50¢
2½	24, 30	21.00¢
2	24, 30	23.00¢
Carbon		
40	100, 110	7.50¢
35	65, 110	7.50¢
30	65, 84, 110	7.50¢
24	72 to 104	7.50¢
17 to 20	84, 90	7.50¢
14	60, 72	8.00¢
10, 12	60	8.25¢
8	60	8.50¢

TOOL STEEL

F.o.b. mill

W	Cr	V	Mo	Co	Base per lb
18	4	1	—	—	90.5¢
18	4	1	—	5	$1.42
18	4	2	—	—	$1.025
1.5	4	1.5	8	—	65¢
6	4	2	6	—	69.5¢

High-carbon-chromium ..... 52¢
Oil hardened manganese ..... 29¢
Special carbon ..... 26.5¢
Extra carbon ..... 22¢
Regular carbon ..... 19¢

Warehouse prices on and east of Mississippi are 2½¢ per lb higher. West of Mississippi, 4½¢ higher.

ELECTRICAL SHEETS

24 gage, HR cut lengths, f.o.b. mill

	Cents per lb
Armature	5.45
Electrical	5.95
Motor	6.70
Dynamo	7.50
Transformer 72	8.05
Transformer 65	8.60
Transformer 58	9.30
Transformer 52	10.10

RAILS, TRACK SUPPLIES

F.o.b. mill

Standard rails, 100 lb and heavier, No. 1 quality, per 100 lb	$3.20
Joint bars, 100 lb	4.25
Light rails per 100 lb	3.55

	Base Price cents per lb
Track spikes	5.35
Axles	5.20
Screw spikes	8.00
Tie plates	4.05
Tie plates, Pittsburg, Calif.*	4.20
Track bolts, untreated	8.25
Track bolts, heat treated, to railroads	8.50

*Seattle, add 30¢.

C-R SPRING STEEL

Base per pound f.o.b. mill

0.26 to 0.40 carbon	4.00¢
0.41 to 0.60 carbon	5.50¢
0.61 to 0.80 carbon	6.10¢
0.81 to 1.05 carbon	8.05¢
1.06 to 1.35 carbon	10.35¢

Worcester, add 0.30¢.

CLAD STEEL

Base prices, cents per pound, f.o.b. mill

	Plate	Sheet
Stainless-carbon		
No. 304, 20 pct,		
Coatesville, Pa.	*26.50	
Washington, Pa.	*26.50	*22.50
Claymont, Del.	*26.50	
Conshohocken, Pa.		*22.50
Nickel-carbon		
10 pct, Coatesville	27.50	
Inconel-carbon		
10 pct Coatesville	36.00	
Monel-carbon		
10 pct, Coatesville	29.00	
No. 302 Stainless-copper-stainless, Carnegie, Pa.		75.00
Aluminized steel sheets		
Hot dip, Butler, Pa.		7.75

* Includes annealing and pickling, or sandblasting.

MERCHANT WIRE PRODUCTS

To the dealer, f.o.b. mill

	Base Column	*Pittsburg, Calif.*
Standard & coated nails*	103	122
Galvanized nails*	103	122
Woven wire fence†	109	132
Fence posts, carloads††	112	...
Single loop bale ties	106	130
Galvanized barbed wire**	123	143
Twisted barbless wire	123	...

* Pgh., Chi., Duluth; Worcester, 6 columns higher. † 15½ gage and heavier. ** On 80 rod spools, in carloads. †† Duluth, Joliet and Johnstown.

	Base per 100 lb	*Pittsburg, Calif.*
Annealed fence wire‡	$4.80	$5.75
Annealed, galv. fencing‡	5.25	6.20
Cut nails, carloads‡‡	6.75	...

‡ Add 30¢ at Worcester; 10¢ at Sparrows Pt.

‡‡ Less 20¢ to jobbers.

HIGH STRENGTH, LOW ALLOY STEELS

Mill base prices, cents per pound

Steel	Aldecor	Corten	Double Strength No. 1	Dynalloy	HI Steel	Mayari R	Otiscoloy	Yoloy	NAX High Tensile
Producer	Republic	Carnegie-Illinois, Republic Sharon*	Republic	Alan Wood	Inland	Bethlehem	Jones & Laughlin	Youngstown Sheet & Tube	Great Lakes Sharon*
Plates	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.45
Sheets									
Hot-rolled	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	5.15
Cold-rolled	6.05	6.05	6.05	.....	6.05	6.05	6.05	6.05	6.25
Galvanized	.....	6.75	.....	.....	.....	6.75	.....	.....	.....
Strip									
Hot-rolled	4.95	4.95	4.95	.....	4.95	4.95	4.95	4.95	5.15
Cold-rolled	.....	.....	6.05	.....	.....	6.05	6.05	6.05	6.25
Shapes	.....	4.95	.....	.....	4.95	5.05	4.95	4.95	.....
Beams	.....	4.95	.....	.....	.....	.....	.....	.....	.....
Bars									
Hot-rolled	5.10	5.10	5.10	.....	5.10	5.10	5.10	5.10	5.30
Bar shapes	.....	5.10	.....	.....	5.10	5.10	5.10	5.10	.....

* Sheets and strip.

WAREHOUSE PRICES

Base prices, f.o.b. warehouse, dollars per 100 lb. (Metropolitan area delivery, add 15c to base price except Cincinnati and New Orleans (*), add 10c; New York, add 20c.)

CITIES	SHEETS			STRIP		PLATES	SHAPES	BARS		ALLOY BARS			
	Hot-Rolled	Cold-Rolled (15 gage)	Galvanized (10 gage)	Hot-Rolled	Cold-Rolled		Standard Structural	Hot-Rolled	Cold-Finished	Hot-Rolled, A 4815 As-rolled	Hot-Rolled, A 4140-50 Ann.	Cold-Drawn, A 4815 As-rolled	Cold-Drawn, A 4140-50 Ann.
Baltimore	5.31	6.21–6.41	6.95–7.11	5.37	....	5.58	5.36	5.42	6.16	....	9.60–10.10	....	....
Birmingham	5.00	....	6.40	5.00	....	5.15	5.00	5.10	6.57	....	....	....	....
Boston	5.55	6.45–6.75	7.11–7.61	5.60–5.95	6.75	5.80	5.42	5.52	6.27	9.67–9.79	10.04–10.07	11.23	11.47
Buffalo	4.85	5.75	7.42–7.57	5.24	7.27	5.35	5.00	4.95	5.40	9.38	9.60	10.85	10.95
Chicago	4.85	5.75	6.85	4.85	5.45–6.15	5.10	4.90	4.90	5.40	8.90	9.26	10.25	10.55
Cincinnati*	5.16–5.51	5.84–6.28	6.59–6.93	5.28–5.43	....	5.53–5.85	5.33	5.33–5.48	6.08–6.20	9.74	9.99	11.19	11.44
Cleveland	4.85	5.75	6.70	5.08	....	5.21	5.01	5.01	5.45	9.05	9.35	10.40	10.70
Detroit	5.28–5.32	6.07–6.18	7.38–7.58	5.27–5.47	6.27–6.58	5.52–5.57	5.33–5.40	5.33–5.55	6.00–6.18	9.67	9.92	11.11	11.35
Houston	6.70–6.95	....	7.30	6.70	....	6.70	6.20–6.70	6.40–6.65	7.68	10.45	10.40	11.45	11.70
Indianapolis	5.29	6.13	7.44	5.29	7.36	5.54	5.34	5.34	6.14	11.25	11.39	....	....
Los Angeles	6.45	7.90	7.45	6.65	7.35[20]	6.15	5.95	6.10	7.95[14]	10.95[15]	10.90[15]	12.45[15]	12.70[15]
Memphis	5.75–5.80	6.60	7.20	5.80–5.95	6.80	5.95–6.00	5.75	5.75	6.53	....	....	....	....
Milwaukee	5.03	5.93	7.02	5.03–5.38	6.32	5.28	5.08	5.08	5.63	9.53	9.73	10.98	11.23
New Orleans*	5.95	6.75	....	6.15	....	6.15	5.95	5.95	6.65[8]	....	....	....	....
New York	5.40	6.31	6.85–6.90	5.62	6.76	5.65	5.33	5.57	6.36	9.28	9.58	10.63	10.93
Norfolk	6.00	....	....	6.20	....	6.05	6.05	6.05	7.05	....	....	....	....
Omaha	6.13	....	8.33	6.13	....	6.38	6.18	6.18	6.98	....	....	....	....
Philadelphia	5.05	6.24[13]	6.58	5.40	6.29	5.35	5.10	5.40	5.94	9.05	9.35	10.62	0.87
Pittsburgh	4.85	5.75	6.90	5.00	6.00	5.05	4.90	4.90	5.40	8.90	9.20	10.25	10.55
Portland	6.50[8]–7.05	8.00	8.80–9.10	6.85[8]	....	6.30[8]	6.35[8]	6.35[8]	8.25[14]	10.50[8]	10.10[6]	....	....
Salt Lake City	7.05	7.05	8.65	7.45[3]	....	5.65[3]	5.80[3]	7.10[8]	8.15	....	....	....	....
San Francisco	6.15[8]	7.50[2]	8.65–7.80	6.75[8]	8.25[8]	6.35[8]	5.90[8]	5.90[8]	7.55	10.90[15]	10.85[15]	12.40[15]	12.65[15]
Seattle	6.70[4]–7.10	8.15[2]–8.65	8.80–9.30	6.70[4]	....	6.35[4]	6.30[4]	6.20[4]	8.15[14]	....	10.35[15]	....	13.10[15]
St. Louis	5.22–5.37	6.12–6.27	7.32	5.22	6.68–7.54	5.47	5.27	5.27	5.82	9.27–9.72	9.57–9.97	10.82–11.17	10.92–11.42
St. Paul	5.44	6.19–6.34	7.54–7.64	5.44	6.82	5.64–6.69	5.49	5.49	6.04	9.49	9.79	10.84	11.14

BASE QUANTITIES

Standard unless otherwise keyed on prices.

HOT-ROLLED:
Sheets, strip, plates, shapes and bars, 400 to 1999 lb.

COLD-ROLLED:
Sheets, 400 to 1499 lb strip, extras on all quantities. Bars 1000 lb and over.

ALLOY BARS:
1000 to 1999 lb.

GALVANIZED SHEETS:
450 to 1499 lb.

EXCEPTIONS:
(1) 400 to 1499 lb; (2) 450 to 1499 lb; (3) 300 to 4999 lb; (4) 300 to 9999 lb; (5) 2000 lb and over; (6) 1000 lb and over; (7) 400 to 14,999 lb; (8) 400 lb and over; (9) 500 to 1999 lb; (10) 500 to 999 lb; (11) 400 to 3999 lb; (12) 450 to 3749 lb; (13) 400 to 1999 lb; (14) 1500 lb and over; (15) 1000 to 4999 lb; (16) 4000 lb and over; (17) up to 1999 lb; (18) 1000 to 1499 lb; (19) 1500 to 3499 lb; (20) 6000 lb and over.

PIG IRON PRICES

Dollars per gross ton. Delivered prices represent minimums. Delivered prices do not include 2 pct tax on freight nor the 6 pct increase on total freight charges in the Eastern Zone (5 pct Southern Zone, 4 pct Western Zone), effective Jan. 11, 1949.

PRODUCING POINT PRICES

Producing Point	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Bethlehem	48.00	.....	.....	.....	.....
Birmingham	38.88	39.38	.....	.....	.....
Buffalo	46.00	46.50	47.00	.....	.....
Chicago	46.00	46.50	46.50	47.00	.....
Cleveland	46.00	46.50	46.50	47.00	51.00
Duluth	46.00	46.50	46.50	47.00	.....
Erie	46.00	46.50	46.50	47.00	.....
Everett	.....	50.00	50.50	.....	.....
Granite City	47.90	48.40	48.90	.....	.....
Ironton, Utah	46.00	46.50	.....	.....	.....
Lone Star, Texas	46.00	46.50†	.....	.....	.....
Neville Island	46.00	46.50	46.50	.....	.....
Provo, Utah	46.00	46.50	.....	.....	.....
Sharpsville	46.00	46.50	46.50	47.00	.....
Steelton	48.00	48.50	49.00	49.50	54.00
Struthers, Ohio	46.00	.....	.....	.....	.....
Swedeland	48.00	48.50	49.00	49.50	.....
Toledo	46.00	46.50	46.50	47.00	.....
Troy, N. Y.	48.00	48.50	49.00	.....	54.00
Youngstown	46.00	46.50	46.50	47.00	.....

DELIVERED PRICES (BASE GRADES)

Consuming Point	Producing Point	Freight Rate	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Boston	Everett	$0.50 Arb.	.....	50.00	50.50	.....	.....
Boston	Steelton	6.27	54.27	54.77	55.27	55.77	60.27
Brooklyn	Steelton	5.48	.....	53.98	54.48	54.98	59.48
Cincinnati	Birmingham	6.09	44.97	45.47	.....	.....	.....
Jersey City	Steelton	3.67	.....	52.17	52.67	53.17	57.67
Los Angeles	Geneva-Ironton	7.13	53.13	53.63	.....	.....	.....
Mansfield	Cleveland-Toledo	3.03	49.03	49.53	49.53	50.03	54.03
Philadelphia	Bethlehem	2.17	50.17	.....	.....	.....	.....
Philadelphia	Swedeland	1.31	49.31	49.81	50.31	50.81	.....
Philadelphia	Steelton	2.81	50.81	51.31	51.81	52.31	56.81
San Francisco	Geneva-Ironton	7.13	53.13	53.63	.....	.....	.....
Seattle	Geneva-Ironton	7.13	53.13	53.63	.....	.....	.....
St. Louis	Granite City	0.75 Arb.	48.65	49.15	49.65	.....	.....
Gulf Ports	Lone Star, Texas	.....	50.50	51.00†	.....	.....	.....

† Low Phos., Southern Grade.

Producing point prices are subject to switching charges; silicon differential (not to exceed 50c per ton for each 0.25 pct silicon content in excess of base grade which is 1.75 to 2.25 pct for foundry iron); phosphorus differentials, a reduction of 50c per ton for phosphorus content of 0.70 pct and over manganese differentials, a charge not to exceed 50c per ton for each 0.50 pct manganese content in excess of 1.00 pct. $2 per ton extra may be charged for 0.5 to 0.75 pct nickel content and $1 per ton extra for each additional 0.25 pct nickel.

Silvery iron (blast furnace) silicon 6.01 to 6.50 pct. C/L per g.t., f.o.b. Jackson, Ohio—$59.50; f.o.b. Buffalo, $60.75. Add $1.00 per ton for each additional 0.50 pct Si up to 17 pct. Add 50c per ton for each 0.50 pct Mn over 1.00 pct. Add $1.00 per ton for 0.75 pct or more P. Bessemer ferrosilicon prices are $1.00 per ton above silvery iron prices of comparable analysis.

Charcoal pig iron base price for low phosphorus $66.00 per gross ton, f.o.b. Lyle, Tenn. Delivered Chicago, $73.78. High phosphorus charcoal pig iron is not being produced.

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Ferromanganese

78-82% Mn, Maximum contract base price, gross ton, lump size.

F.o.b. Birmingham	$174
F.o.b. Niagara Falls, Alloy, W. Va., Weland, Ont.	$172
F.o.b. Johnstown, Pa.	$174
F.o.b. Sheridan, Pa.	$172
F.o.b. Etna, Pa.	$175

$2.00 for each 1% above 82% Mn, penalty, $2.15 for each 1% below 78%.

Briquets—Cents per pound of briquet, delivered, 66% contained Mn.

Carload, bulk	10.45
Ton lots	12.05
Less ton lots	12.95

Spiegeleisen

Contract prices gross ton, lump, f.o.b.

	16-19% Mn 3% max. Si	19-21% Mn 3% max. Si
Palmerton, Pa.	$64.00	$65.00
Pgh. or Chicago	65.00	66.00

Manganese Metal

Contract basis, 2 in. x down, cents per pound of metal, delivered.

96% min. Mn, 0.2% max. C, 1% max. Si, 2% max. Fe.

Carload, packed	35.5
Ton lots	37.0

Electrolytic Manganese

F.o.b. Knoxville, Tenn., freight allowed east of Mississippi, cents per pound.

Carloads	28
Ton lots	30
Less ton lots	32

Low-Carbon Ferromanganese

Contract price, cents per pound Mn contained, lump size, delivered.

	Carloads	Ton	Less
0.07% max. C, 0.06% P, 90% Mn	25.25	27.10	28.30
0.10% max. C	24.75	26.60	27.80
0.15% max. C	24.25	26.10	27.30
0.30% max. C	23.75	25.60	26.80
0.50% max. C	23.25	25.10	26.30
0.75% max. C, 7.00% max. Si	20.25	22.10	23.30

Silicomanganese

Contract basis, lump size, cents per pound of metal, delivered, 65-68% Mn, 18-20% Si, 1.5% max. C. For 2% max. C, deduct 0.2¢.

Carload bulk	8.95
Ton lots	10.60
Briquet, contract basis carlots, bulk delivered, per lb of briquet	10.30
Ton lots	11.90
Less ton lots	12.80

Silvery Iron (electric furnace)

Si 14.01 to 14.50 pct, f.o.b. Keokuk, Iowa, $77.00; Si 15.01 to 15.50 pct, f.o.b. Niagara Falls, N. Y., $73.50; Electric furnace silvery iron is not being produced at Jackson. Add $1.00 per ton for each additional 0.50% Si up to and including 18%. Add $1.00 for each 0.50% Mn over 1%.

Silicon Metal

Contract price, cents per pound contained Si, lump size, delivered, for ton lots packed.

96% Si, 2% Fe	20.70
97% Si, 1% Fe	21.10

Silicon Briquets

Contract price, cents per pound of briquet, bulk, delivered, 40% Si, 1 lb Si briquets.

Carload, bulk	6.30
Ton lots	7.90
Less ton lots	8.80

Electric Ferrosilicon

Contract price, cents per pound contained Si, lump size, bulk, in carloads, delivered.

25% Si	18.50
50% Si	11.30
75% Si	13.50
85% Si	14.65
90-95% Si	16.50

Calcium Metal

Eastern zone contract prices, cents per pound of metal, delivered.

	Cast	Turnings	Distilled
Ton lots	$2.05	$2.95	$3.75
Less ton lots	2.40	3.30	4.55

Ferrochrome

Contract prices, cents per pound, contained Cr, lump size, bulk, in carloads, delivered. (65-72% Cr, 2% max. Si)

0.06% C	28.75
0.10% C	28.25
0.15% C	28.00
0.20% C	27.75
0.50% C	27.50
1.00% C	27.25
2.00% C	27.00
65-69% Cr, 4-9% C	20.50
62-66% Cr, 4-6% C, 6-9% Si	21.35

Briquets — Contract price, cents per pound of briquet, delivered, 60% chromium.

Carload bulk	13.75
Ton lots	15.25
Less ton lots	16.15

High-Nitrogen Ferrochrome

Low-carbon type: 67-72% Cr, 0.75% N. Add 5¢ per lb to regular low carbon ferrochrome price schedule. Add 5¢ for each additional 0.25% N.

S. M. Ferrochrome

Contract price, cents per pound chromium contained, lump size, delivered.

High carbon type: 60-65% Cr, 4-6% Si, 4-6% Mn, 4-6% C.

Carloads	21.60
Ton lots	23.75
Less ton lots	25.25

Low carbon type: 62-66% Cr, 4-6% Si, 4-6% Mn, 1.25% max. C.

Carloads	27.75
Ton lots	30.05
Less ton lots	31.85

Chromium Metal

Contract prices, cents per lb chromium contained packed, delivered, ton lots. 97% min. Cr, 1% max. Fe.

0.20% max. C	1.09
0.50% max. C	1.05
9.00% min. C	1.04

Calcium-Silicon

Contract price per lb of alloy, lump, delivered.

30-33% Ca, 60-65% Si, 3.00% max. Fe.

Carloads	17.90
Ton lots	21.00
Less ton lots	22.50

Calcium-Manganese—Silicon

Contract prices, cents per lb of alloy, lump, delivered.

16-20% Ca, 14-18% Mn, 53-59% Si.

Carloads	19.25
Ton lots	21.55
Less ton lots	22.55

CMSZ

Contract price, cents per pound of alloy, delivered.

Alloy 4: 45-49% Cr, 4-6% Mn, 18-21% Si, 1.25-1.75% Zr, 3.00-4.5% C.

Alloy 5: 50-56% Cr, 4-6% Mn, 13.50-16.00% Si, 0.75 to 1.25% Zr, 3.50-5.00% C.

Ton lots	19.75
Less ton lots	21.00

V Foundry Alloy

Cents per pound of alloy, f.o.b. Suspension Bridge, N. Y., freight allowed, max. St. Louis. V-5: 38-42% Cr, 17-19% Si, 8-11% Mn.

Ton lots	15.75¢
Less ton lots	17.00¢

Graphidox No. 4

Cents per pound of alloy, f.o.b. Suspension Bridge, N. Y., freight allowed, max. St. Louis. Si 48 to 52%, Ti 9 to 11% Ca 5 to 7%.

Carload packed	17.00¢
Ton lots to carload packed	18.00¢
Less ton lots	19.50¢

SMZ

Contract price, cents per pound of alloy, delivered. 60-65% Si, 5-7% Mn, 5-7% Zr, 20% Fe, ½ in. x 12 mesh.

Ton lots	17.25
Less ton lots	18.50

Other Ferroalloys

Ferrotungsten, standard, lump or ¾ x down, packed, per pound contained W, 5 ton lots, delivered	$2.25
Ferrovanadium, 35-55%, contract basis, delivered, per pound, contained, V.	
Openhearth	$2.90
Crucible	3.00
High speed steel (Primos)	3.10
Vanadium pentoxide, 88-92% V_2O_5 contract basis, per pound contained V_2O_5	$1.20
Ferrocolumbium, 50-60% contract basis, delivered, per pound contained Cb.	
Ton lots	$2.90
Less ton lots	2.95
Ferromolybdenum, 55-75%, f.o.b. Langeloth, Pa., per pound contained Mo.	$1.10
Calcium molybdate, 45-50%, f.o.b. Langeloth, Pa., per pound contained Mo.	96¢
Molybdenum oxide briquets, f.o.b. Langeloth, Pa.; bags, f.o.b. Wash., Pa., per pound contained Mo.	95¢
Ferrotitanium, 40%, regular grade, 10% C max., f.o.b. Niagara Falls, N. Y., freight allowed east of Mississippi and north of Baltimore, ton lots, per lb contained Ti	$1.21
Ferrotitanium, 25%, low carbon, f.o.b. Niagara Falls, N.Y., freight allowed east of Mississippi and north of Baltimore, ton lots, per lb contained Ti	$1.40
Less ton lots	1.45
Ferrotitanium, 15 to 19%, high carbon, f.o.b. Niagara Falls, N. Y., freight allowed east of Mississippi and north of Baltimore, carloads per net ton	$160.00
Ferrophosphorus, electrolytic, 23-26%, carlots, f.o.b. Siglo, Mt. Pleasant, Tenn., $3 unitage, per gross ton	$65.00
10 tons to less carload	75.00
Zirconium, 35-40%, contract basis, f.o.b. plant, freight allowed, per pound of alloy.	
Ton lots	21.00¢
Zirconium, 12-15%, contract basis, lump, delivered, per pound of alloy.	
Carload, bulk	6.60¢
Alsifer, 20% Al, 40% Si, 40% Fe, contract basis, f.o.b. Suspension Bridge, N. Y.	
Carload	7.40¢
Ton lots	8.80¢
Simanal, 20% Si, 20% Mn, 20% Al, contract basis, f.o.b. Philo, Ohio, freight allowed, per pound	
Carload, bulk, lump	11.00¢
Ton lots, bulk, lump	11.50¢
Ton lots, packed, lump	11.75¢
Less ton lots, lump	12.25¢

Boron Agents

Contract prices, per lb of alloy, del.

Ferroboron, 17.50% min. B, 1.50% max. Si, 0.50% max. Al, 0.50% max. C, 1 in. x D. Ton lot	$1.20
F.o.b. Wash., Pa.; 100 lb and over	
10 to 14% B.	.75
14 to 19% B.	1.20
19% min. B.	1.60
Manganese—Boron 75.00% Mn, 15-20% B, 5% max. Fe, 1.50% max. Si, 3.00% max. C, 2 in. x D, delivered.	
Ton lots	$1.67
Less ton lots	1.79
Nickel—Boron 15-18% B, 1.00% max. Al, 1.50% max. Si, 0.50% max. C, 3.00% max. Fe, balance Ni, delivered.	
Less ton lots	$1.80
Silcaz, contract basis, delivered	
Ton lots	45.00¢
Grainal, f.o.b. Bridgeville, Pa., freight allowed, 100 lb and over.	
No. 1	93¢
No. 6	63¢
No. 79	45¢
Bortam, f.o.b. Niagara Falls	
Ton lots, per pound	45¢
Less ton lots, per pound	50¢
Carbortam, f.o.b. Suspension Bridge, N. Y.; freight allowed, Ti 15-18%, B 1.00-1.50%, Si 2.5-3.0%, Al 1.0-2.0%.	
Ton lots, per pound	$.6350
Borosil, f.o.b. Philo, Ohio, freight allowed, B 3-4%, Si 40-45%, per lb contained B	$4.35

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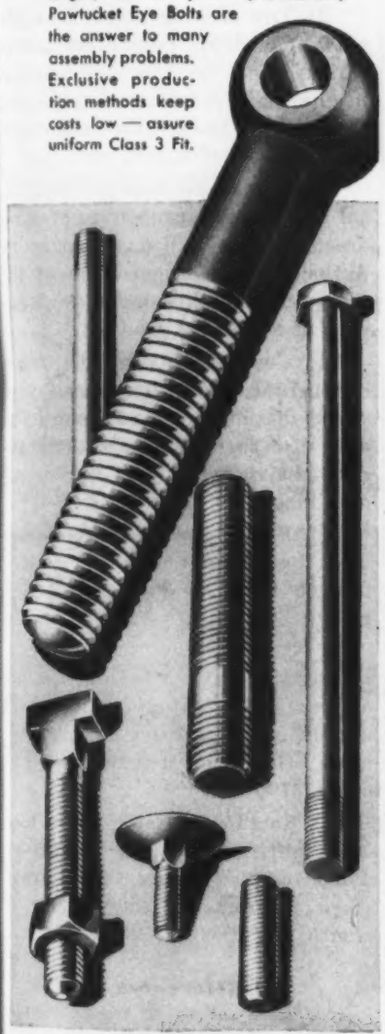

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High Temperature Properties

(Continued from Page 105)

and 10½ to 13½ in. from the hot face contained 7 to 9 pct liquids at their hot load failure temperature. Samples from the hot end also showed much greater intercrystalline growth which promotes higher load strength.

Spalling resistance of each section of the brick is closely associated with the amount of periclase recrystallization. Those sections which had extensive recrystallization showed a greater spalling loss than those whose recrystallization was small. In all cases, spalling loss was greater than that of an unused brick.

The developments of large crystals in the sections of brick that had the greatest thermal treatment, reduced their flexibility. When strains are developed by sudden temperature fluctuations, the structure is so rigid that the strain can only be relieved by a fracture in the brick. The section containing a concentration of silicate minerals has a lower spalling loss than sections from the hot face. Lower spalling loss is probably the result of greater flexibility rather than different chemical content.

In summary, this study of a high purity magnesia refractory, after prolonged exposure to a temperature of 3800°F, has shown that such heating produces extensive changes in chemical and mineralogical character and in physical and thermal properties of the brick. Migration of relatively low-melting minerals in the brick away from the high temperature and their concentration in cooler zones have been found. The results of the thermal tests suggest that such migration may be one of the processes leading to the eventual failure of refractories at high temperatures, since the alteration of properties resulting from this action may weaken a

This investigation was conducted jointly by Permanente Metals Corp. and by Food Machinery and Chemical Corp., and the authors express their appreciation to the respective managements for permission to publish this article.

(Continued on Page 158)

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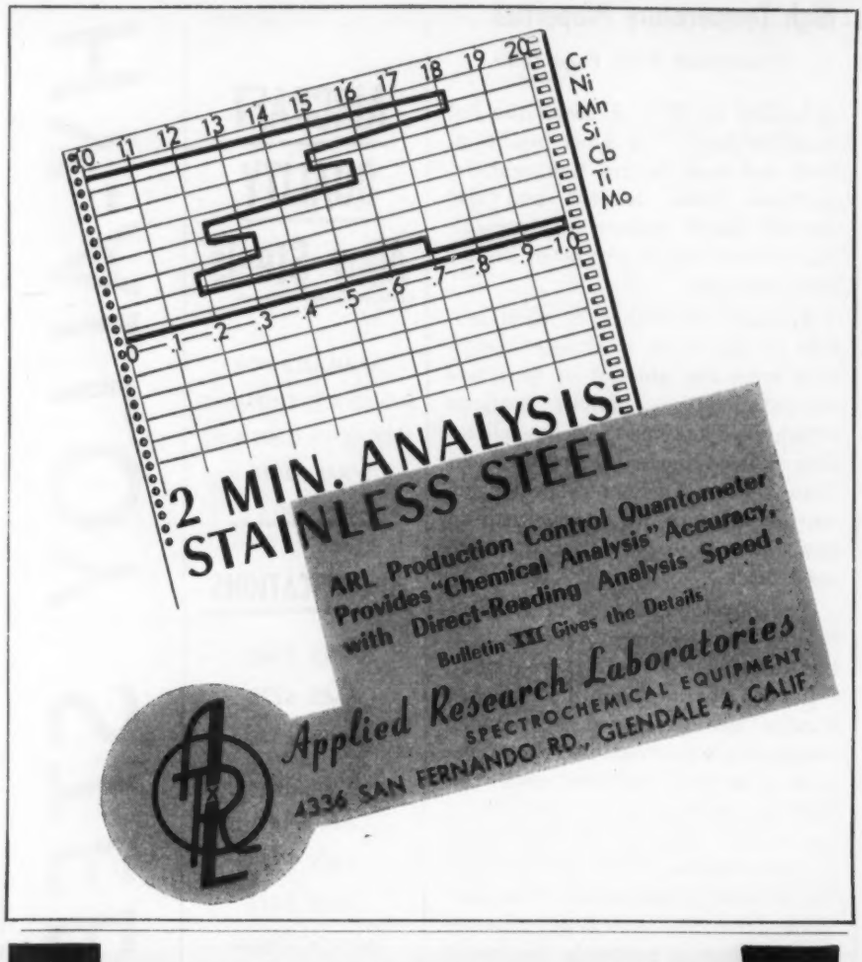

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High Temperature Properties

Continued

brick below critical limits at certain points.

The observations have the following conclusions:

(1) High purity magnesia refractories of the type studied, even when suspended freely, should be serviceable under carefully controlled conditions to temperatures as high as 3800°F.

(2) Low-melting minor constituents of a high purity refractory which do not go into solid solution in the main refractory component can migrate toward the cooler portions of the refractory structure.

(3) Significant changes in physical and thermal properties of a refractory may be brought about by diffusion and concentration of the minor constituents under the influence of a thermal gradient.

(4) Concentration of the oxides of calcium, silicon and boron, as a result of diffusion under the influence of a thermal gradient, will reduce the refractoriness under load of a magnesia brick.

(5) Spalling resistance of a magnesia brick is reduced by exposure to 3800°F for 1 month, when tested by the modified ASTM method used here.

(6) Small amounts, under 1 pct of iron and aluminum oxides, will not diffuse in a high purity magnesia brick below a temperature of about 3700°F.

(7) Small periclase crystals in a high purity magnesia refractory will grow 20 or more times larger when exposed to 3800°F for 1 month.

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[7] Von G. Tammann, Zeitschrift fur Angewandte Chemie, vol. 39, 1926, p. 869.

National Supply's Net Drops

Pittsburgh — National Supply Co. reported net income of $1,423,762 during the second quarter, down more than 50 pct from the $3,060,277 earned during the first quarter. The company's earnings for the first 6 months were larger than for the first half of 1948. National Supply's net income was $4,484,039 in thes 6 months ended June 30, against $3,642,978 in the comparable period last year.

Sales in the second quarter were $36,199,000, a decline of $4,200,000 from the previous quarter.

Blaw-Knox Net Increased

Pittsburgh—Blaw-Knox Co. reported net profits of $1,952,858 for the first 6 months of this year, compared with $1,793,169 earned in the first half of 1948.

Billings for the first half of 1949 amounted to $35,518,828, compared with $29,935,209 in the corresponding 1948 period. The backlog of unfilled orders amounted to $28.8 million at June 30, 1949, compared with $39 million at the beginning of the year and $29.5 million, Jan. 1, 1948.

Gain by Baldwin Locomotive

Philadelphia—The Baldwin Locomotive Works reported that consolidated sales of the company and its wholly owned subsidiaries for the 6 months ended June 30, 1949, were $68,032,019 and that net profit for the period amounted to $1,829,627. Sales for 1948 were $61,711,160 and net profit of $1,618,118 for the 6 months ended June 30, 1948.

Orders booked during the 6 months ended June 30, 1949 amounted to $31,232,193 and orders unfilled as of June 30, 1949 amounted to $68,010,049 as compared with orders booked during the 6 months ended June 30, 1948, amounting to $68,211,601, and orders unfilled as of June 30, 1948, amounting to $122,571,569.

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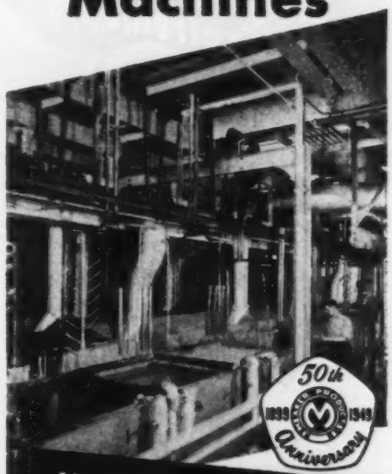

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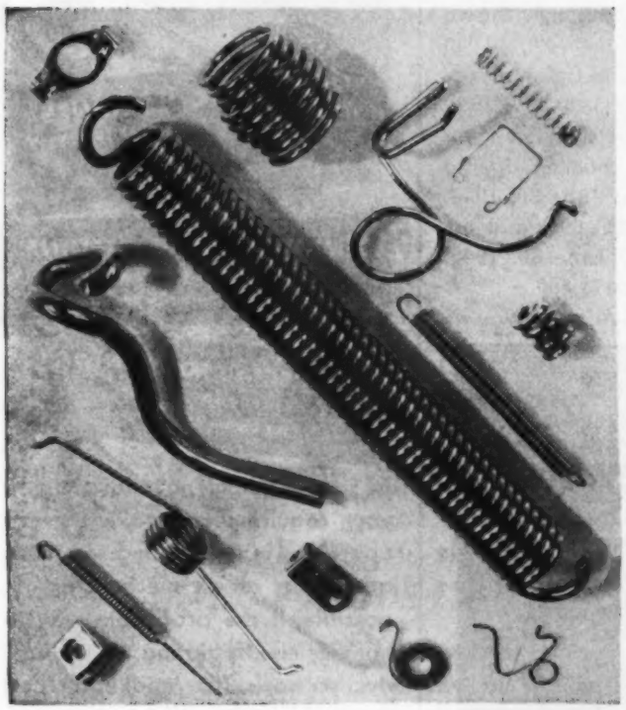

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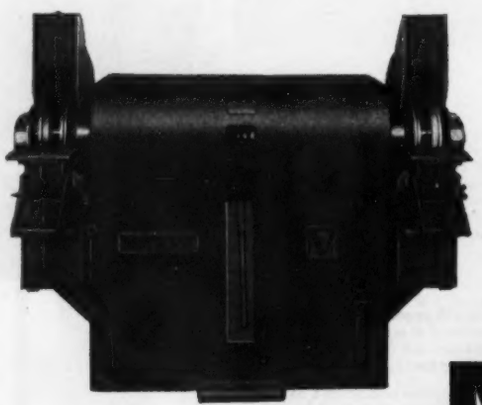

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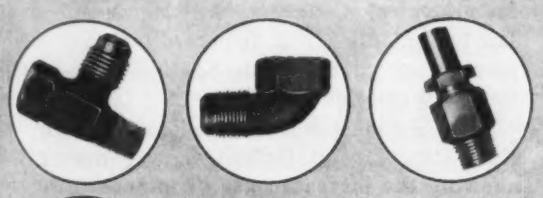

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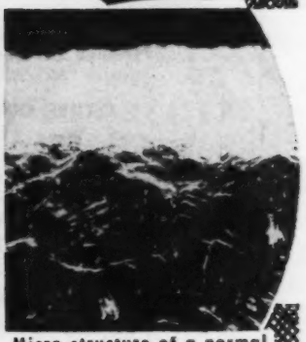

Micro-structure of a normal nitrided case showing the white surface layer which generally must be removed by grinding or lapping.

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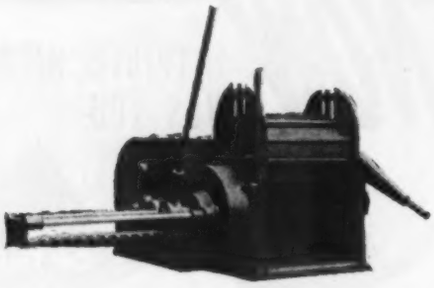

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GLOBAL LETTER
REVIEW OF WORLD MARKETS

(Continued from Page 60)

international market. The annual target of 400,000 tons of exports per year to France also depends on more economical transportation. The ore runs from 32 to 50 pct Mn content.

To Build Pipe Mill in Italy

Washington—Ferrotubi, a subsidiary of Fabrica Italiana Tuba, Milan, has received a $220,000 ECA grant which, with $260,000 in capital provided locally, will finance a new welded pipe mill. The plant will be able to produce between 1800 and 3000 tons annually in ⅛ to 3-in. diam pipe. About 2/3 of its output is intended for the domestic market and about a third for export.

Mining & Metallurgical Men Study Utilization of Minerals

Oxford—How to get and how to make the most of the minerals which are urgently needed in industry were the subjects of discussion for 600 delegates to the Fourth Empire Mining and Metallurgical Congress, which assembled in London on July 9, and dispersed late last month after visits to Scotland, North-East England, Cornwall and South Wales.

During the technical sessions, held in the University City of Oxford, figures were given showing the increased use of minerals, the depletion of many sources, and the danger of serious restriction of industry unless new deposits of minerals are found and the most made of the existing sources by skilful mining and new processes in fabrication and finishing.

One means of increasing supplies is to mine more deeply. The problems involved, particularly the health of the workers in relation to output, were the subject of a series of papers, one of which discussed the degree of perspiration required for maximum efficiency.

Sees Minerals Being Dissipated

Sir Henry Tizard, top-ranking British scientist, in his presidential address to the Congress,

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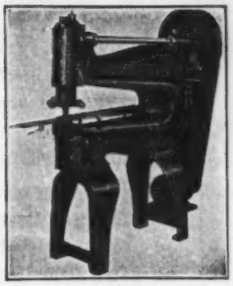

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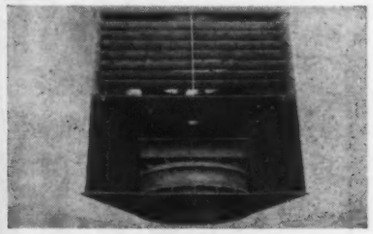

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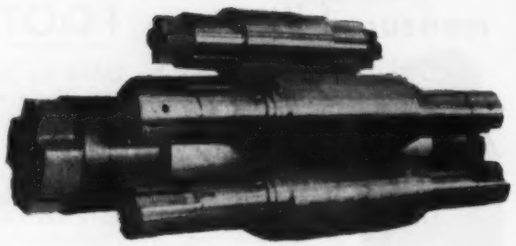

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GLOBAL LETTER

(Continued from Page 162)

said: "In my lifetime more irreplaceable minerals have been dissipated than in the whole previous history of the world. The rate of consumption goes on increasing and no one is going to put a limit to the rate.

"No one could be certain, from existing knowledge, that some of the metals on which so much depended, such as lead and tin, would be available in sufficient quantity in a hundred year's time. Most minerals had been found accidentally, either by such chance occurrences as the cutting of a railway line or during the wanderings of adventurous prospectors. Such accidental discoveries are not at an end, but we can not rely on them for the future. Applied science needed to be continuously developed on a firm foundation of fundamental knowledge. We needed to encourage and stimulate the basic science of geophysics in its broader aspects."

American Delegates Present

U. S. delegates included: Dr. W. M. Conn, Dr. W. D. Johnston, U. S. Geological Survey; Lt.-Col. G. M. Liddell, Mining and Metallurgical Society of America; T. H. Miller, U. S. Dept. of the Interior, Bureau of Mines; D. E. Morgan, and G. B. Walker, American Institute of Mining & Metallurgical Engineers; and W. E. Wrather, U. S. Geological Survey.

U. K. Working on 100 Planes

London—A survey of the 30 principal airframe companies and seven aircraft engine manufacturers in the United Kingdom shows that more than 100 aeroplanes and at least 40 engines are in production, under construction, in process of development or in an advanced stage of design—excluding an unspecified number of heavy jet bombers and new night fighters which are on order for the Royal Air Force. This also excludes certain aero-engines which are still on the secret list.

Of the 60 planes in production, nine are jet-propelled and three have turboprop engines. Of the 25 engines in production, five are turbojets and four turboprops. Excluding aircraft which are serving as flying test beds for new engines, nine of the experimental aeroplanes now flying are jet-propelled and four have turboprop engines.

Of 18 prototypes under construction, five are designed to take turboprop engines and five will have jets. Experimental engines now being flight tested include two turboprops and one turbojet; those under construction or on bench tests include five turboprop engines and one turbojet.

(Resume reading on Page 83)